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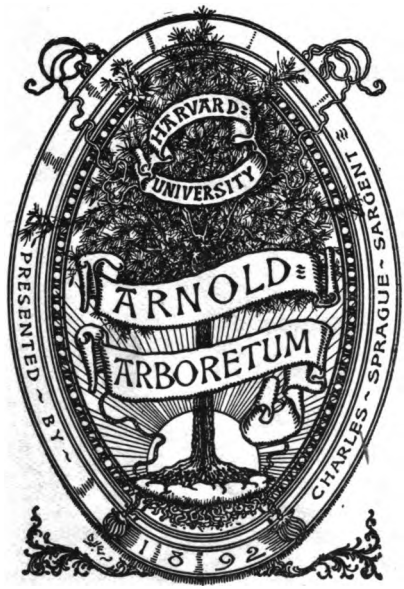
Royal Scottish Arboricultural Society



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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

LIEUT.-COLONEL F. BAILEY, F.R.S.E.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

I. Heredity and Forestry.[1]

By WILLIAM SOMERVILLE, M.A., D.Sc., D.Œc.,
Professor of Rural Economy, Oxford.

Perhaps the title of this short address does not quite clearly express the scope of the few remarks that I have to make, so I may at once explain that I do not intend to attempt to deal in detail with the transmission of the characters of a tree to its offspring, but merely to bring to your notice the results of some interesting, and, I think, suggestive experiments that have been conducted in Switzerland and Austria on behalf of the Departments of Forestry of the respective countries. I have had the opportunity of inspecting the Austrian work, which was initiated and is still being conducted by Dr Cieslar, and I have discussed in detail with Professor Engler the scheme and results of the Swiss work. I therefore speak, to some extent, from personal acquaintance with the results, and the fact that such acquaintance made a considerable impression on me has induced me to bring the matter before this Society, in the hope that it may stimulate your interest, and perhaps induce some of you to make experiments in the same direction.

Both in Austria and in Switzerland the spruce and larch (especially the former) have received most attention, in Austria some work has also been done with the Scots pine, while in Switzerland the silver fir and sycamore have also been experimented with. The silver fir, however, has not been found to give any information of value, while the results with the Scots pine are scarcely complete enough to make it necessary to discuss them on the present occasion. We will therefore confine our attention to the spruce, larch, and

[1] Read before the Society at the General Meeting on 11th July, 1907.

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sycamore, three trees well known in this country, and widely distributed throughout Europe.

First of all, taking up the spruce, let us see what the Swiss results have to show.

TABLE I.

Swiss Experiments with Common Spruce Seed (Crop 1898) sowed at Adlisberg (Zurich).

Seed produced at—	Altitude.	Seed Unsorted, sown 1899.		Seed Sorted, sown 1900.						4-Year Old Plants.	5-Year Old Plants.	
		2-Year Old Seedlings.										
				Large Seed		Medium Seed.		Small Seed.				
		Height.	Weight per 1000.	Height.	Weight per 1000.	Height.	Weight per 1000.	Height.	Weight per 1000.	Height.	Height.	Weight per 100.
	Ft.	Ins.	Oz.	In.	Oz.	Ins.	Oz.	Ins.	Oz.	Ins.	Ins.	Lbs.
Winterthur, . .	1800	5·3	25	4·2	29	3·8	25	3·4	26	11·8	18	15
Adlisberg, . . .	2200	4·0	20	...	...	...	...	...	...	9·2	14	10
Pilatus, ...	3300	3·7	16	4·1	34	3·5	19	3·3	16	8·7	14	10
Graubünden, . .	5100	2·1	13	2·2	13	2·1	11	1·7	9	5·9	10	6
Engadine, ...	5950	2·0	10	2·1	12	1·9	10	1·8	10	5·7	9	5

The general scheme of the experiments has consisted in procuring seed from trees of approximately equal age situated at different elevations. A careful study has been made of the size and colour of the cones, of the shape and dimensions of the trees and their foliage, and of the size and germinating capacity of the seed. The seed has been sown in two nurseries, the one (Adlisberg, near Zürich) at an altitude of some 2200 feet, and the other (Stanserhorn) at an altitude of some 6200 feet. The latter is situated at so high an elevation that any results obtained there can have but a modified interest for us, so I propose to confine our attention to the work at the lower elevation, which, though much above the limits of successful tree-growth in this country, presents conditions analogous to those found at a height, say, of about 500 feet in Scotland. I do not, however,

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wish to suggest that the results obtained either in Switzerland or Austria can be immediately applied to our own conditions. My whole object in bringing the work to your notice is to stimulate interest, and to suggest that there is room for further research along similar lines, which, however, shall have strict regard to our peculiar insular conditions.

The examination of the seed showed that there was a gradual, though by no means regular, reduction in size according as it was obtained from low or high elevations, 1000 seeds usually weighing more than 6 grammes when obtained from an altitude under 3000 feet, and less than 6 grammes when the altitude was 3000 to 6000 feet. The percentage germination followed the same order, being about 70 to 80 for lower altitudes, 50 to 60 for higher altitudes. When the seed was kept over from year to year, the germinating capacity, of course, in every case declined; but the reduction in germinating power was much more marked in the case of high-grown seed than in the case of seed from low elevations. As a rule, seed from a high elevation did not germinate at all six years after being gathered, whereas seed from a low elevation would still germinate about 20 per cent.

When the seedlings had reached an age of two years, many were lifted and subjected to examination in various ways, when it was found, amongst other things, that the proportion of root to stem was greater in the case of plants from high-grown seed than where the seed had been procured at a low elevation. This character has doubtless been acquired by trees at a high altitude in order better to resist the violent gales to which they are subjected, and it is a character that has been transmitted through the seed.

But by far the most important result of these experiments is that which is concerned with the relationship between the rate of growth of the seedlings and the elevation at which the seed was gathered. Up to a certain altitude above sea-level trees grow as well as they do lower down; but as one gets higher a point is reached when the height-growth begins to be affected, and at the upper reaches of growth for any particular species, the trees are more or less stunted. Now, this reduction in the stature of trees is a character that is inherited; that is to say, it is transmitted to the progeny. It has already been mentioned that the seed of the spruce is smaller in size at high than at

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low elevations; and that large seed produces large plants may be at once admitted. Table I. shows that when the seed was passed through sieves and sorted out into "large," "medium," and "small" grains, the resultant plants, when two years old, were always slightly tallest and heaviest when the largest seed had been used, and shortest and lightest when the smallest seed had been sown. But this does not explain why seed from a high elevation, when sown at a lower level, produces comparatively small plants; for the same result is got when seed has been sorted, and when the comparison is with grains of exactly equal size. The Table shows that in the case of unsorted seed, gathered at altitudes varying from 1800 to 5950 feet, and sown in 1899, the two-year-old seedlings averaged 5·3 inches in height, and weighed 25 oz. per 1000 when the seed came from mother-trees growing at the lower level, but only 2 inches and 10 oz. when the mother-trees had stood nearly 6000 feet above the sea. The Table also shows a gradual transition from the big to the little seedlings, according to the elevation of the seed-trees, but in inverse proportion, that is to say, the higher the elevation of the seed-trees the shorter and lighter the resulting plants. The character, it will be seen, is preserved by the seedlings when they are five years old—at that age the plants from Winterthur seed being 18 inches high, and 15 lbs. in weight per 100; whereas plants raised from Engadine seed were at that age only 9 inches high and 5 lbs. per 100 in weight.

The more important results of the Austrian experiments with spruce are brought together in Tables II. and III. In the former of these Tables figures are shown dealing with seed from three different localities, and from three different altitudes in each locality. This seed was gathered in the autumn of 1890, and was sown in 1891 in a nursery in the Wienerwald, near Vienna, at an altitude of 1650 feet. When sufficiently large the plants were set out in the forest, and the measurements for 1905, shown in the Table, refer, of course, to the fifteen-year-old plants. Here, as in the Swiss experiments, seed from high elevations *usually* produced plants whose growth is slow, so that from seed gathered at Kärnten, at an altitude of 1700 feet, the plants were 53 inches high, whereas when the seed came from 5200 feet in the same district, the fifteen-year-old plants were only 30 inches high. Similarly for the seed from South Tyrol and the south of France, except that in the case of seed from the middle altitude in the

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latter case the resultant plants were slightly taller than from the lower altitude. In the same Table the average growth-in-height for the year 1905 is also shown, that is to say, the average length of the last shoot. Fifteen years after sowing the seed the slower growth of plants from seed harvested at a high altitude is still as conspicuous as ever, and it seems probable that this characteristic will be maintained throughout the life of the tree. The poor growth, on the whole, during 1905 is accounted for by the extraordinary intensity of the drought of 1904, which was continued with but little modification throughout 1905.

TABLE II.

Austrian Experiments with Spruce (*Crop* 1890) *in the Wienerwald* (1650 *feet*).

Origin of Seed.	Altitude.	Height-Growth, 1905.	Height in 1905.
	Ft.	Ins.	Ins.
Kärnten, ...	1700	4·2	53
,, ...	3400	2·9	40
,, ...	5200	2·4	30
South Tyrol, . . .	3300	3·6	39
,, . . .	5500	2·4	28
,, . . .	5800	1·6	21
South France, . . .	3000	2·6	30
,, . . .	4900	2·3	32
,, . . .	5100	2·0	24
Central Sweden, . . .	1000	1·3	12

In the lowest line of the above Table (II.) figures are shown which relate to plants grown from Swedish seed, and it will be seen how very poorly such plants have grown in Central Austria.

Table III. also deals with Austrian experiments on spruce, the seed in this case being of the crop of 1894. This seed, from three altitudes in Silesia, has produced plants of exactly the same character as the others already discussed. The leading shoot in

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1906 (the twelfth year from the seed) averaged 8·6 inches in length when the seed came from an altitude of 1700 feet, whereas it was only 2·3 inches long in the case of the plants raised from seed produced at an elevation of 3750 feet.

TABLE III.

Austrian Experiments with Spruce (*Crop* 1894) *in the Wienerwald.*

Origin of Seed.	Altitude.	Height-Growth, 1906.	Height in 1906.
	Ft.	Ins.	Ins.
Silesia, ...	1700	8·6	47
,, ...	2850	6·0	38
,, ...	3750	2·3	23
Central Sweden, . . .	?	3·4	18

Austrian Experiments with Larch.

Origin of Seed.	Height, 8-Year Old Plants.	
	Ft.	Ins.
Silesia, ...	6	8
Alps, ...	5	2

In this Table, as in the last, the poor growth in Austria of Swedish spruce is strikingly emphasised.

So much for spruce. Now let us turn to the principal results obtained with larch.

The lower part of Table III. shows the height to which eight-year-old larches had attained when raised from seed produced respectively in Silesia and the Alps. Not only were the alpine larches shorter, but they were also less straight, and even at eight years of age they showed a tendency to produce buttress-like outgrowths or ribs. This lack of straightness, and the tendency to throw out buttresses, is thoroughly characteristic of the larch when grown in high alpine localities, and there can be no doubt, from the Austrian experiments, that these characters are also transmitted from the parent tree to its offspring.

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The Swiss Forest Department has also experimented with larch (crop 1900), and the main results are brought together in Table IV. In the first place, attention may be called to the general tendency for high-grown seed to produce short plants, though it must also be noted that this result was not observable until the parent trees had stood at an altitude of some 6000 feet.

TABLE IV.

Swiss Experiments with Larch Seed (Crop 1900) in Nursery at Adlisberg (2200 feet).

Origin of Seed.	Altitude.	4-Year-Old Plants.		
		Height.	Leaves Appeared.	Stopped Growing.
	Ft.	Ins.		
Bonaduz,* . . .	2350	26	April 8	August 18
Untervaz,* . . .	3700	27	,,	,, 6
S. Maria, . . .	5600	25	April 3	,, 6
Avers,* . . .	6300	9	March 29	June 27
Engadine,* . . .	6900	15	,,	July 2

* Several trees.

Besides this character of high-grown seed, the Table also shows that the four-year-old larches varied to some extent as regards the date when they came into leaf, the plants from high-grown seed becoming green some days before the others. But much more striking was the period when growth ceased for the season, this occurring in the end of June or early in July for the plants raised from high-grown seed, but not till well into August in the case of the plants from low-grown seed. The growing season was thus a month to six weeks shorter in the former case than in the latter. Needless to say, these results have an important bearing on the liability of plants to be affected by late and early frosts, a form of injury to which the larch is specially subject.

Finally, a few of the results obtained with the sycamore in the Swiss experiments have been brought together in Table V. These plants were raised from seed sown in 1901, and when

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three years old they showed the average heights stated in the Table. When seed was taken from trees situated at elevations ranging up to 3600 feet, the resulting plants showed but little difference in size, the advantage being rather in favour of the higher-grown seed. But in the case of seed produced above 5000 feet, the plants were distinctly shorter, agreeing in this respect with the results obtained with spruce and larch. When the dates of coming into leaf are examined, it is seen that plants from high-grown seed are somewhat later than the others, whereas they show a tendency to stop growing sooner, and they certainly shed their leaves earlier.

TABLE V.

Swiss Experiments with Sycamore (*Crop* 1900) *in Nursery at Adlisberg* (2200 *feet*).

Origin of Seed.	Altitude.	3-Year-Old Plants			
		Height.	Leaves Appeared.	Stopped Growing.	Leaves Shed.
	Ft.	Ins.			
Adlisberg, . . .	2200	25	May 5	July 31	Nov. 12
Hasenrüten, . . .	3150	26	,, 10	,, 15	,, 14
Kalcherli, . . .	3500	27	,, 10	,, 31	,, 14
Wiesenberg, . .	3600	31	,, 10	,, 31	,, 14
Platti, . . .	5200	22	,, 16	,, 15	,, 6
Alp Drusen, . . .	5300	16	,, 16	,, 5	Oct. 13

As previously stated, it would be most unsafe to apply these Austrian and Swiss results to the conditions prevailing in Scotland; but in the countries referred to there is no doubt that where plantations of spruce and larch are being formed at low or moderate altitudes, care should be taken to secure seed from similar localities. In the experimental plantations near Vienna, one finds that an area stocked with plants from low-grown seed is in close canopy with all ground-herbage suppressed, when on an adjoining area the young trees, raised from high-grown seed, are far from touching each other. It is perfectly evident that in the one case the profits of forestry will

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be much larger than in the other, in fact, there may at the end of the rotation be all the difference between a satisfactory profit and a dead loss.

Although I have not troubled you with figures for plants raised at what, on the Continent, would be called a high altitude, I may mention that whereas seed from a low or moderate elevation is clearly indicated as the best for cultivation at such elevations, this class of seed produced plants that throve badly at high altitudes. For use at high altitudes, seed from similar altitudes must be obtained, and it seems to be not unlikely that in Scotland we might cultivate woods at greater heights than we do if we made a point of securing high-grown coniferous seed for the purpose. I am aware that Scots pines from home-grown seed are much more highly valued than so-called "German-Scotch," and I have not a doubt that the prejudice against foreign Scots pine plants is thoroughly well founded. But the home supplies of Scots pine seed are often insufficient to meet requirements, and, in any case, we want to have extensive experiments set a-going to see whether any foreign locality can furnish as good Scots pines as we grow at home. While we are probably sound in our belief with regard to Scots pine, I fear we know but little as to where we should turn for the best supplies of spruce and larch, and some other important trees. If larches that possess crooked and buttressed stems can produce plants having similar characters, the question naturally arises, can the tendency to disease be similarly transmitted? The tendency to injury from frost can certainly be transmitted, as we have just seen in the case of the Swiss experiments, and it is possible that some cases of want of success with this tree are due to the unsuitability of the source of supply of the seed. Similarly in the case of the spruce. How often do we see young spruces almost standing still in their growth, with foliage yellow, and branches covered with galls! These are exactly the symptoms that characterise some of the experimental plantations in Austria, and it may well be that our spruces also have sprung from seed ill-adapted to our peculiar conditions. Pending the production of reliable experimental results in this country, we cannot do better than take care to obtain our seed from well-grown healthy trees situated in the district where the woods are to be grown, or in a district of similar character.

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2. The Mountain Pine.

(With Five Plates.)

By Sir JOHN STIRLING-MAXWELL, Bart.

The Editor has asked me to contribute some notes on this species, which certainly deserves the attention of any forester who has to bring poor, high and exposed ground under forest.

The classification of the Mountain Pine is still incomplete, and presents difficulties into which these notes will not enter. The botanical nomenclature will also be avoided, as it is in a state of confusion, and presents more varieties than the tree itself.

From the forester's point of view there are three well-marked varieties of the Mountain Pine, which I will call Upright, Intermediate, and Dwarf. These are not mere sports, but constant varieties, hailing from different countries, coming true from seed, and, in fact, not less distinct than the Corsican, Austrian, and Pyrenean varieties of *Pinus Laricio*.

1. The Upright Mountain Pine, known in France as *Pin à Crochets* from its hooked cone scales (Fig. 1), is a slender, erect-growing tree with a single stem, which, under favourable conditions, attains a height of 60 feet or more. It is the ruling species in large forests at elevations of 4000 to 7000 feet in the Pyrenees and in the French Alps near Briançon. It is also found in small colonies in the Engadine and on the moors of Southern Bohemia.[1]

2. The Intermediate form is a many-stemmed tree, which does not grow more than half the height of the Upright variety. Its shape is due to the rapid development of the side branches, which turn upwards and grow as fast as the leader. This is the variety commonly found in the mountains of Central Europe and on the Bavarian moors.

3. The Dwarf form is a creeping shrub not more than 6 feet high. Its branches tend to lie flat on the ground, only turning upwards at the extremities, and it has no leader. This variety forms vast thickets in the Carpathians, and on the Erz and Riesen mountains, which divide Bohemia from Saxony. It has no silvicultural interest, and need not concern us further.

[1] P. E. Müller, *Tidsskrift for Skovbrug*, Copenhagen, 1887.

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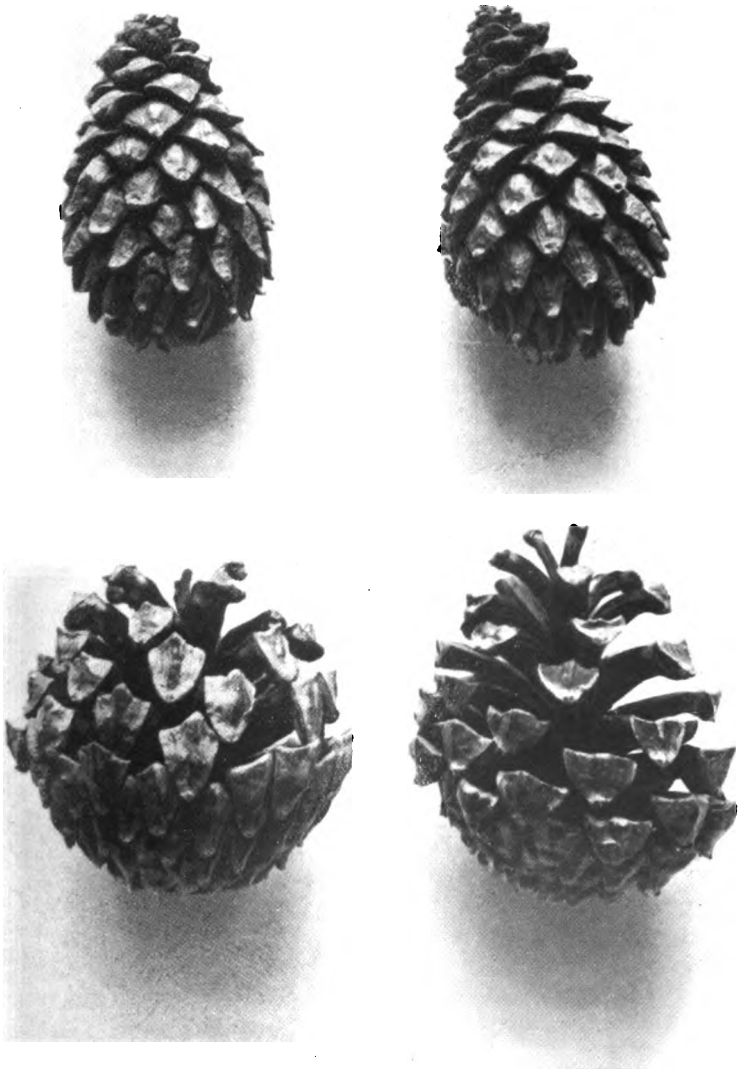
PLATE I.



[*Photo by Lady Mary Percy.*

FIG. 1.—Cones of Upright Mountain Pine, Pyrénées Orientales; Natural Size.

[*To face page 10.*

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The Mountain Pine is one of the least exacting of trees, whether as regards soil, or aspect, or climate, and its requirements decrease with its stature. No doubt the humbler types, and their frugal character, are the outcome of the miserable homes to which the species has been for generations reduced. The present distribution of the three varieties, and perhaps also their origin, depends mainly on the encroachment of other species. Even in this, its noblest form, the Mountain Pine can thrive at altitudes where it has nothing to fear from the Scots pine or silver fir. But the hardy spruce is a more dangerous rival. Where it is present, the Mountain Pine is driven to higher ground. In such situations, too inclement for the Upright variety, the Mountain Pine is only found in the many-stemmed Intermediate form. Farther east, according to Müller,[1] the Mountain Pine, even in this form, finds a serious rival in *Pinus Cembra*, and it is only the Dwarf variety that can scrape a living on the wind-swept tops to which *Pinus Cembra* does not mount. In the Alps the Upright variety is found only where the spruce is absent. The spruce appears to avoid the Briançonnais because it is too dry. Here, in the region above the Scots pine and silver fir, the Mountain Pine has no rival but the larch, with which it lives on friendly terms, germinating freely under the larch's light shade, and taking full advantage later of its broken canopy.

In the Pyrenees the conditions are still more favourable to the Mountain Pine. There the spruce is, for some unexplained reason, a scarce tree, found sparsely mixed with the silver fir, but never as a ruling species. The larch is altogether absent. The Mountain Pine consequently reigns supreme and almost alone in vast tracts of forest; for where it can thrive in its Upright form (and it is found in the Pyrenees in no other), it has nothing to fear from the encroachments of *Pinus Cembra*, the only other conifer of this high region. The Mountain Pine forests are found on the Spanish as well as the French side of the frontier. Their aspect is sombre, but very beautiful. Mile after mile they mount over ground rough with boulders, and still plentifully streaked with snow in the last days of May. The grey stems are so straight and cylindrical, and the crowns so narrow, that you seem to be in a larch forest which has exchanged its gay, deciduous foliage for this deep perennial verdure. The finest

[1] P. E. Müller, *Tidsskrift for Skovbrug*, Copenhagen, 1887.

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groves are the least accessible, which it has never paid to fell. They were hopelessly out of reach at the time of my pilgrimage. The forest officers said they knew specimens 100 feet high and 9 feet in circumference. If the reader wishes to verify these figures, he can only do so in July or August. In the lower Mountain Pine forests it is possible to work four months in the year. Here a system of *Jardinage* is practised, under which no trees reach the age of 100. Figs. 2 and 3 show a fine group in the Forêt Communal de Matemale, at a turn of the road between Mont Louis and Fourmiguères. These trees, judging by the stumps of some lately cut, are about 70 years old. They are 55 feet high, and average 3 feet in girth breast high. The largest measured 4 feet. The photographs, being taken from lower ground, do injustice to the stems, which are remarkably cylindrical. Fig. 4 is a group of Mountain Pines in the Forêt de la Matte, near Fourmiguères. Part of this forest is of Scots pine, and in places the two species are mixed. The reader may care to know how their growths compare here and in the French Alps, where the two species also meet. Up to 40 their growth in height is about equal. At Briançon it scarcely exceeds 40 feet for either species. But in that time the Scots pine, if it has escaped injury from snow, has invariably made more timber than its neighbour, measuring on an average 2 ft. 3 ins. in girth breast high, while the Mountain Pine only measures 1 ft. 8½ ins. On the buttresses of Mont Canigou, where the Mountain Pine is mixed with stunted silver fir, the growth is nearly double that above described. After the age of 40 there is usually a marked falling off in the height-growth of the Mountain Pine. Up to that age it is a singularly regular and slender tree (Figs. 6 and 7), never branching into gaps like the Scots pine. After 40 the stem swells, the crown gets rounder, and the branches hang down, but the tree seldom loses its narrow, columnar habit. A well-developed tree of 70 years carries branches notably short and light for its heavy cylindrical stem. At every stage the outline resembles that of the Corsican pine. The root-system of the Mountain Pine is shallower than that of the Scots pine, and at high altitudes the Scots pine can only keep pace with its more frugal cousin on the better soils. The condition of the two species, after a winter of heavy snow like that of 1906-1907, is in marked contrast. The Mountain Pine, among its crushed and splintered

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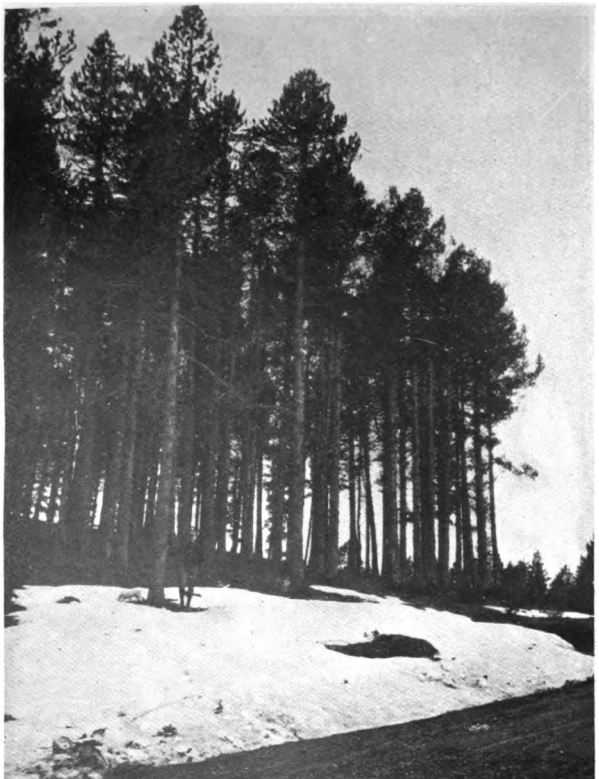

FIG. 2.—Upright Mountain Pine, 70 years old, Forêt de Matemale, Pyrénées Orientales.

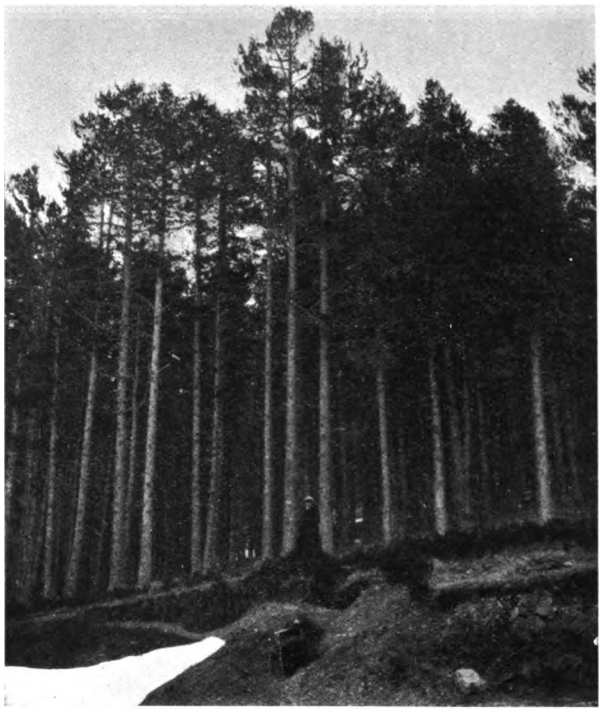

FIG. 3.—Upright Mountain Pine, 70 years old, Forêt de Matemale, Pyrénées Orientales.

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PLATE III.

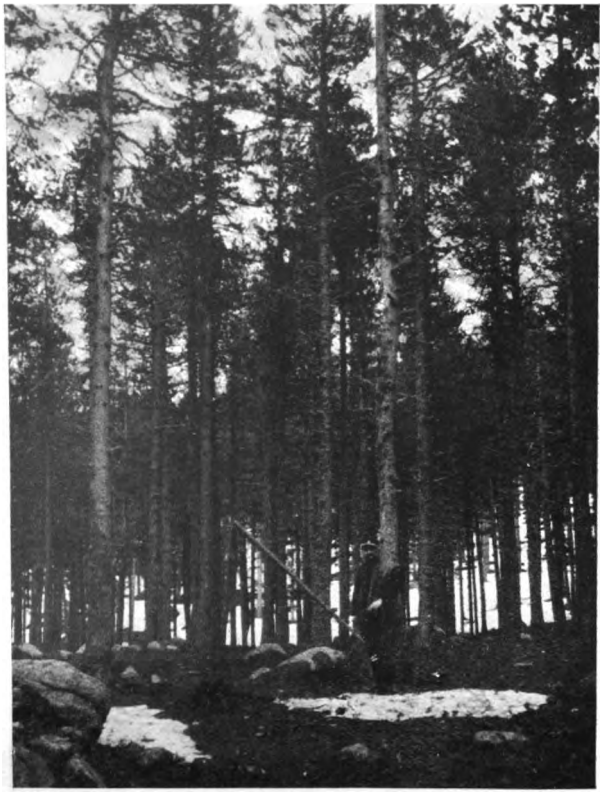

FIG. 4 -Upright Mountain Pine, Forêt de la Matte, Pyrénées Orientales.

FIG. 5.—Upright Mountain Pine, recovering from snow, Forêt de Barrés, Mont Louis.

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neighbours, might sing with the Psalmist, "They are brought down and fallen: but we are risen, and stand upright." The recovery of the Mountain Pine from snow is one of the marvels of these woods. Even where trees of twenty years' growth have been bowed to the ground (as in Figs. 5 and 8), their wonderful toughness and elasticity enable them to stand up again in spring little the worse.

The Mountain Pine cleans its stem less readily than the Scots pine, being distinctly less impatient of shade. It also retains its needles longer, often eight and even nine years in the young state, as against four or five for the Scots pine. It is perhaps for this reason that new plantations of Mountain Pine make such slow progress for several years on poor soils. In one, for instance (Fig. 9), in the Clairée valley near Briançon, on a poor gravel almost destitute of vegetation, the Mountain Pine had taken fourteen years to reach the height of 6 feet. During that time hardly a vestige of humus can have been formed. During the last eight years the progress has been much more rapid, and the gravel is now hidden under 3 inches of dark humus-soil, which bears a plentiful crop of seedlings. In spite of its persistent foliage, the crown of the Upright Mountain Pine is never dense, because the growth of the side branches is slow, and consists, for the most part, of a simple extension of the main axis without side shoots. For the afforestation of poor soils, as in the Cevennes or Montagne Noir, or in plantations for the restraint of torrents in the higher valleys of the Alps and Pyrenees, the Mountain Pine has quite replaced the Scots pine in the estimation of French foresters. At Briançon, for instance, Scots pine is no longer grown in the nurseries. At Mont Louis the French government have a seed-drying establishment on a large scale, with store-rooms, and ovens and threshing machinery, which is mainly devoted to the seed of the Upright Mountain Pine. The same work is carried on at Briançon.

The Upright Mountain Pine yields a good timber, with red heart-wood, tough, resinous and durable. In the barrack buildings at Mont Louis, it survives in good condition from the seventeenth century. The specific gravity, as tested in Denmark, is higher than that of Scots pine, but lower than that of larch. The timber is highly esteemed for building. It is well adapted, on account of the abundance of resin, for the manufacture of charcoal, tar, and ligneous acid, but, not for the same

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reason, of cellulose.[1] In the Pyrenees the expense of transit is so great that the timber is disposed of locally so far as possible. The price is there slightly below that of Scots pine, as the local demand is for the wood more easily worked.

In Denmark the Mountain Pine, in its Intermediate form, has played an important part in the afforestation of the heaths and dunes of Jutland. It was introduced into Denmark from Eisenach in 1798. It did not come into prominence until the middle of the nineteenth century, when the wholesale destruction of the plantations of Scots and Austrian pine by *Lophodermium Pinastri* induced the Danish foresters to turn their attention to a species which had escaped that pest. The plantations of Mountain Pine now cover more than 15,000 acres. It is only since 1886 that the Upright variety has been planted on a large scale. It promises well, but is found rather more exacting as regards soil than the Intermediate form, and rather more subject to *Lophodermium Pinastri*. Specimens forty to forty-five years old prove that the tree maintains its erect habit in Denmark.[1]

On the Danish heaths the Mountain Pine displays a wonderful power of resistance to humic acid, and is found to improve heath soil for other species in a manner which is described by Danish writers as "remarkable and partly unexplainable."[1] It does not appear certain that the Upright variety shares this valuable quality. If it does, it cannot fail to be of value in Scotland. Danish foresters assert that the Intermediate variety can make its good influence felt among spruce when it is in the low proportion of one to four. In the Pyrenees the Upright variety has the reputation of succeeding well on peat and in swampy places, but a plantation on soil of this character in the Forêt de Barrés, near Mont Louis, does not look particularly happy; it is, however, on an undrained snipe bog, such as the most sanguine Scot would shrink from planting.

It is a pity that the Upright variety of Mountain Pine is so little known in this country. It will be seen from the few illustrations given that it is absurd to dismiss this species as a mere bush, as most British writers do. No one would advocate its employment where more valuable kinds would thrive, but it appears to have the merit of living and making good timber where other kinds fail. An admirable description

[1] *Haandbog i Skovbrug*, Hauch & Oppermann, Copenhagen, 1898-1902.

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FIG. 6.—Young growth of Upright Mountain Pine, Pyrénées Orientales.

FIG. 7.—Young growth of Upright Mountain Pine, near Briançon.

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FIG. 8.—Upright Mountain Pine, newly released from snow, Forêt de Barrés, Mont Louis.

FIG. 9.—Plantation of Upright Mountain Pine, Vallée de Clairée, near Briançon.

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of the Mountain Pine will be found in *Sketches in Spain* by Capt. S. E. Cook (Widdrington), 1834. Loudon follows it in his *Arboretum*. Numerous French writers, including Boppe, Matthieu, Demontzey, etc., give fairly adequate accounts of the tree, as well as Willkomm, and several Danish writers. The seed of the Intermediate variety can be obtained from Rafn of Copenhagen. For the seed of the Upright variety it is better to apply to the French Department *des Eaux et Forêts*. Application must be made through the British Embassy in Paris. Both seeds are cheap, and can be relied on to germinate well if treated in the same manner as Scots pine.

The Nomenclature of the Mountain Pine.

By Marion I. Newbigin, D.Sc.

This subject is admittedly difficult, one great source of difficulty being that the growth-forms of the tree do not altogether correspond to the cone-forms, which are fairly well defined. A useful summary of the various classifications proposed is given in *Lebensgeschichte d. Blütenpflanzen Mitteleuropas*, by Kirchner, Loew and Schröter, with a suggested classification, on which the following notes are based.

If we examine the cones only we find that *Pinus montana* may be split up into three well-defined subspecies—(1) *uncinata*, (2) *pumilio*, and (3) *mughus*. Upright and intermediate forms only occur in the first, which is therefore the only one which directly interests the forester. In this subspecies the cones are markedly unsymmetrical, have an excentric stalk, and are narrowed at the base. The scale-shields (apophyses) are better developed on the free side of the cone than on that turned to the stalk, and are raised so as to form a cap or pyramid. In this subspecies two varieties occur. In (1) *P. montana uncinata* var. *rostrata* the shield is strongly hooked, and the pyramid forming the hook is as high or higher than it is broad. The pyramid is well shown in the lower left-hand cone in the plate. This variety is especially western, occurring naturally in Spain, the Pyrenees, the western Alps and western Switzerland. It is typically upright, but under very unfavourable conditions sports into the dwarf form. Such dwarf sports will, however, apparently give seeds which reproduce the upright form. In (2) *P. montana uncinata* var. *rotundata* the hook is less well marked, the pyramid, if present, is not so high as it is broad, and may be represented only by a cap in the upper part of the shield. This variety is more widely spread than the other, occurring throughout the Alps except to the west. It is cultivated in Denmark and Germany, and occurs especially in the intermediate form, but is sometimes dwarf. The dwarf forms come true from seed. In brief, the true upright form is *P. montana uncinata* var. *rostrata*, the true intermediate *P. montana uncinata* var. *rotundata*, but both of these may also occur in the dwarf form. The dwarf forms of these two varieties are either (1) sports, or (2) constant races.

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3. Soil: its Origin and Nature.

By Professor JAMES GEIKIE, LL.D., D.C.L., F.R.S.

(*Continued from* Vol. XX. p. 182.)

II.

Soils are usually classified by agriculturists as (*a*) *Sedentary* and (*b*) *Transported*. These terms, however, are true only of subsoils. All soils, properly so-called, may be said to be sedentary, inasmuch as they are formed out of the immediately underlying subsoils. To a geologist "soil" and "subsoil," no matter how intimately related, are nevertheless distinct things. Subsoil is an aggregate of disintegrated and decomposing rock-material, while soil consists of similar materials, with the addition of a varying amount of organic matter. True soil rarely exceeds one foot in thickness, and is usually thinner; but subsoil may vary in depth from a few inches up to hundreds of feet.

For this country a more suitable classification of soils would be (*a*) *Bed-rock Soils* and (*b*) *Drift Soils*. Under the former head would be included all soils overlying subsoils which are in process of being derived from the breaking-up and disintegration of the bed-rock. The latter term, on the other hand, would embrace all soils formed upon the surface of superficial formations of every kind. These "superficial formations" overlie and conceal the bed-rock, and are of very unequal thickness and varied origin—the soils yielded by them differing, it may be, entirely from the subsoils and soils which the concealed bed-rocks themselves would have supplied. A short description of a few typical examples of bed-rock soils and drift soils may suffice to illustrate the varying character of these two great groups.

(*a*) BED-ROCK SOILS.

The bed-rocks of this country differ greatly as regards their character and origin. Some consist of confused aggregates of crystalline ingredients, and are obviously of igneous origin, having cooled and consolidated from a molten condition. Such are the well-known rocks granite and basalt. Others resemble these in being crystalline, but differ from them in showing a certain arrangement of their ingredients in more or less regular lines or layers. Crystalline rocks having this leafy arrange-

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ment are termed schists. Gneiss and mica-schist are common examples. Yet another great class of rocks are known as derivative rocks. These are so called because they have been derived from the breaking-up of pre-existing rocks, and the deposition of the materials in layers and beds. Characteristic rocks of this group are ordinary sandstones and argillaceous shales. To the same group belong the great marine limestones, which consist chiefly of the débris of corals, sea-lilies, shells, and other organisms.

1. IGNEOUS ROCKS.—The soils resulting from the disintegration and decomposition of igneous rocks show considerable variety. As typical examples we may cite granite and basalt.

Granite, as we have seen, is essentially an aggregate of three minerals—quartz, felspar, and mica or some other ferro-magnesian species. While quartz is insoluble, the other constituents are in time decomposed by rain, and resolved into clay and certain alkalies and alkaline earths, which tend to be removed in solution as bicarbonates. When thoroughly decomposed, therefore, granite yields a clay-soil, containing a variable admixture of grit and sand (quartz). From this clay all the soluble ingredients—potash, magnesia, and lime—may be completely leached out. In general, however, larger and smaller fragments of the decomposing rock are disseminated more or less plentifully through the soil and subsoil, and from these fresh supplies of the alkalies and alkaline earths are continually set free.[1] Other minerals besides those mentioned may be present in granite—the most notable being apatite, from the decomposition of which phosphoric acid is added to the soil. Under favourable conditions, therefore, granite yields a fertile clay-soil. In this country, however, the rock usually occurs at considerable elevations, where the climatic conditions and the form of the ground are against the retention in place of its decomposing débris. The disintegrated materials, unprotected by vegetation, fall a prey to wind, rain, and melting snow, and are carried more or less rapidly away. Steep declivities thus either remain bare or are curtained with sheets of loose boulders, blocks, and fragments of all shapes and sizes, while more gently

[1] The common felspar of typical granite contains potash. The soil over this rock, therefore, may be expected to contain a good supply of that substance. Not infrequently the mineral hornblende is more or less plentifully present, from the decomposition of which lime is derived.

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inclined surfaces may be clothed with rough grit and gravel, consisting largely of insoluble quartz. Over the low grounds clay is sometimes spread to some extent; but from this the soluble alkalies and alkaline earths may have been largely removed.

Basalt is a dark-coloured rock which, as a rule, is readily disintegrated and decomposed. It contains a considerably smaller percentage of silica than granite, and a much larger proportion of basic ingredients. The essential constituents are felspar and augite—usually accompanied by olivine and iron-oxides, and not infrequently by apatite, but no quartz is present. From the decomposition of these minerals various soluble and insoluble compounds are produced. The former are represented chiefly by carbonates of lime, potash, and magnesia, while the latter appear as clay and fine sand, commingled with which are iron-oxides. The resulting soil is a dark loam, which often shows traces of phosphoric acid, derived from the decomposition of the apatite. Basalt-rocks are fairly common in the lowlands of Scotland, entering often largely into the formation of hill-ranges, and frequently occurring as more or less isolated knolls and straggling hillocks, or forming wider stretches of lumpy and hummocky ground.

Granite and basalt may be taken as representative of igneous rocks in general—the former yielding, under favourable conditions, clay-soils, while from the latter, soils of a loamy character tend to be produced. There are many other igneous rocks, however, a few approximating to granite in chemical composition; others being more nearly related to basalt. Rocks of this intermediate character necessarily yield soils—some of which are clay-like, while others are loamy. Generally they are more or less fertile.

2. SCHISTS.—The rocks included under this head are of very variable nature, and are often termed "metamorphic," because they are believed to have undergone certain great changes which have obscured or even sometimes entirely concealed their original character. The most typical kinds are markedly crystalline; but others may show only slight indications of crystalline texture.

Gneiss is one of the more crystalline varieties, and resembles granite in composition, consisting, like it, of quartz, felspar, and one or more ferro-magnesian silicates. It therefore tends to yield a clay-soil with the usual admixture of grit. According,

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as conditions of climate and surface-slope are favourable or the reverse, the soil may be good or practically barren. In this country the rock is largely confined to the Highlands, and therefore it is only here and there that its disintegrated and decomposing materials are allowed to remain for any time *in situ*.

Mica-schist.—This rock is also largely restricted to our mountain districts. Typical mica-schist, consisting of quartz and mica only, weathers slowly, and the thin soils derived from it are generally of poor quality. But not infrequently many accessory ingredients are more or less plentifully present in mica-schist—such as felspar, garnet, apatite, and sometimes calcite. When the gradients are favourable, the soils derived from such mica-schists may be as good as or even better than those yielded by granite and gneiss. They are often rather loams than clays, and under favourable conditions have proved to be fairly fertile.

Now and again we encounter schistose rocks which have essentially the same composition as some of our dark-coloured basic igneous rocks, and the resulting soils in such cases are dark loams of good quality. Unfortunately, the rocks referred to (*amphibolites*) are somewhat sparingly developed in Scotland, occupy no large areas, and often occur at relatively high elevations—being confined to our Highland areas.

The only other metamorphic rocks that need be referred to are *clay-slate* and *quartzite*—both of which occupy considerable areas in the Highlands. The former consists essentially of silicate of alumina, and its disintegrated materials, therefore, usually form a cold, wet, sterile clay. Occasionally, however, owing to the presence of felspathic and micaceous ingredients, the soil is of a less forbidding quality. As *quartzite* consists essentially of quartz, its disintegrated débris forms at the best only a thin, meagre, sandy soil.

3. Derivative Rocks.—In this division many varieties of rock are placed. Some, however, are but sparingly developed, and need not be here considered. Excluding these, we may say that the great majority consist either of arenaceous, argillaceous, or calcareous materials.

Arenaceous Rocks.—The most characteristic of these rocks are the sandstones, of which there are many varieties. The great majority are quartzose, that is to say, they are made up chiefly of

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grains of quartz, and hence the soils derived from them tend to be light, and are often not sufficiently retentive. Many sandstones, however, contain larger or smaller proportions of argillaceous matter diffused through them, and may then yield loamy soils of good quality. Now and again we meet with sandstones which have been derived more or less immediately from the breaking-up of such rocks as granite, gneiss, etc. Such sandstones often contain much decomposing felspar, and various more or less altered ferro-magnesian minerals, particularly mica—from which soluble alkalies and alkaline earths are obtained. Few sandstones, indeed, do not contain scales of mica, which are often so plentiful as to give the rock quite a fissile structure. However abundant such minerals may be in a sandstone, they are not often conspicuous in the overlying subsoil, while they are wholly wanting in the vegetable soil. It is obvious, in short, that they become decomposed, and in the process yield compounds available for plant-food. Many sandstones owe their induration to some cementing material which binds the grains together. This material may be calcareous, ferruginous, or argillaceous. When such rocks are weathered, therefore, the nature of the cementing material necessarily affects the character of the soil. There are certain very old arenaceous rocks, which contain so large a proportion of argillaceous material that the soils formed upon them are often rather clays than loams. The rocks referred to are termed *greywacké* by geologists. They are relatively hard, greyish-blue or greenish as a rule, and are known to the country folk as *whinstones*. The Lammermuirs, the Lowthers, and other hill-ranges in the south of Scotland are built up very largely of these rocks. Although the soils derived from greywackés are not infrequently too retentive, yet here and there, when they can be well drained, they are cultivated with success. It may be added that greywackés not infrequently contain considerable porportions of felspathic material, the decomposition of which naturally enriches the soil.

Sandstones may occur either in thick massive beds or in thinner strata, and the individual beds are very frequently separated by intervening layers of argillaceous shale. Hence when a series of sandstones and shales crop out at the surface, the soils derived from both sets of beds eventually become commingled. This, of course, is due to that movement of soil-materials which is always in progress. Thus in regions where

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sandstones and shales occur in rapid succession, the overlying soil is usually of a loamy character.

Argillaceous Rocks.—The rocks of this class are as variable in character as those just described. Naturally the soils given by them are clay-like. Many of the rocks in question consist almost exclusively of silicate of alumina and quartz in the finest state of division—all soluble ingredients being practically wanting. Such rocks, it need hardly be said, crumble down into cold, wet, retentive, infertile clays. Some clay-rocks, on the other hand, contain much sand, so that the soil resulting from their disintegration is of a transition or loamy character. Again, certain clay-rocks are largely charged with calcareous matter, and would be then termed *marls*—some of which yield excellent soils.

While argillaceous rocks sometimes occupy wide regions—the prevalent soils of which are consequently of a heavy, clay-like nature, yet more frequently the rocks in question are interbedded with sandstones. When such is the case, the resulting soils, as we have seen, are often strong loams, forming some of the most fertile land met with in this country. Good examples are furnished by the famous "red soils" of East Lothian, Wales, and Cornwall, all of which overlie Old Red Sandstone strata. Somewhat similar soils are yielded by the "Keuper Marl" of Cheshire and the Midlands of England.

Calcareous Rocks.—Limestones invariably contain insoluble impurities, such as sand and clay—they do not consist exclusively of calcium carbonate. Thus the soils derived from limestone are either loams or clays. They are usually reddish, yellowish, or brown in colour, and vary in character from stiff retentive clays to calcareous loams. Good examples of these soils are seen in the chalk districts of England. Limestones all the world over yield somewhat similar coloured soils—the colour being due to the presence of iron-oxides. As limestones are usually traversed by numerous joints or fissures which have been widened by the action of acidulated water, much of the red earth (*i.e.*, the insoluble portion of the rock) is washed by rain, or, as the case may be, by melting snow, into these open fissures. Limestone regions, therefore, especially when relatively high, are apt to show a bare rocky surface, the hollows of which may be sparingly sprinkled with a thin clay-like or loamy soil.

[*Note.*—This article will be concluded in our next issue.]

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4. The Inverliever State Forest.

By R. C. Munro Ferguson, M.P.

The Royal Scottish Arboricultural Society has every reason to be gratified with the acquisition of Inverliever. We have put pressure upon successive Governments for a long while past in order to obtain two definite objects of supreme importance,—

(1) Provision for the training of foresters;

(2) Acceptance by the State of liability for the afforestation of suitable lands.

Our requirements for the training of foresters were detailed by Mr Hanbury's Departmental Committee, whose very moderate recommendations remain neglected. Yet it is facilities for instruction and for experimental work, as laid down by that Committee, that are our chief requirement. All this has yet to be obtained, and we cannot insist on it too strongly, in view of the fact that the Secretary for Scotland has, unfortunately and unaccountably, refused to extend to Scotland a most useful inquiry, which is now being conducted into technical rural training in England—a decision which prevents this essential but neglected branch of our educational system from being submitted to independent and competent investigators.

The evidence and report published by the Forestry Committee of 1902 laid much stress upon the immense scope that exists for State afforestation, especially in Scotland. And it is satisfactory to note that, in spite of the general apathy of Ministers and their officials, our Society's action is receiving support both from the Office of Woods and Forests, whose administration, thanks to Mr Stafford Howard, is now more enlightened, and from the Labour Party in search of work for the unemployed, as well as from a considerable mass of independent public opinion. It is interesting to observe that those who believe in land nationalisation as a general principle, and those who do not, have alike discovered that for this one object, if for no other, they can heartily co-operate. The policy of State afforestation has behind it the most opposite schools of politicians, thinkers, and practical men; and it is this happy union of opinion, in favour of a sound and inevitable policy, that has at length induced the Government to make a start with one of the items of our programme, namely, the State afforesta-

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tion of the Highlands as a commercial enterprise. That is what Inverliever represents, and nothing more. It is but the first step on a long road which will eventually lead to the acquisition of several millions of acres for State forests. It is a step that should be firmly planted, and for the next year or two there is little to be done save to press on with the preliminary organisation necessary to establish a regular Forest Plan for these 12,000 acres. In connection with this undertaking, it would be well to have a small Scottish Advisory Council whom the expert in charge of the planting and planning could consult about initiatory proceedings. As soon as Inverliever is fairly under way—and no time should be lost—we shall have to persuade the State to extend its possessions and to develop larger and larger areas of suitable country.

What we have to do now, as the Government refuses to allow the question of landward technical instruction to be opened in Scotland, is to take the matter into our own hands, and unceasingly to insist upon the purchase of the demonstration area which is so absolutely essential to any scheme of silvicultural training. We need 10,000 to 15,000 acres, with at least a couple of thousand acres of woodland upon it. Some large estate might be acquired with a view to keeping only what is needed, or else two or three small estates, forming a group in the same locality, might furnish between them the necessary specimens of mature and growing timber, together with bare land for experimental planting and observation forests; or, better still, one estate might be acquired in the Highlands for instruction in the growth and utilisation of coniferous timber, and another in the Lowlands for the same operations in hardwood: the Highlands having almost unrivalled advantages for the first product, and there being great scope in the Lowlands for raising many most valuable hardwoods. Inverliever, being almost bare, is useless for purposes of instruction, invaluable though it is as being a new departure in sound social and economic State policy. A demonstration forest—soon to become the sphere of a properly equipped forest school—is what we must now concentrate our energies on securing with the least possible delay. It could be laid out at little expense under a competent expert, and were land acquired at the rates current of late years, there should be little, if any, loss on the transaction. Eventually, of course, money would

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be required for the equipment of the forest school, from which there would be, if no direct return, an incalculable public advantage, because, without it, neither the State nor the private owner has any chance of succeeding. These are points which need little discussion here, for upon them we have all been for long agreed.

Another consideration which must now be dealt with is the establishment of a Scottish Board of Forestry. Such a body, or else a Commission under the Board of Agriculture, is needed at once to schedule land suited to silviculture, more especially in the Highlands. This area should be defined and marked off, not only with a view to drafting a comprehensive scheme of State afforestation, but—and this would be its first duty—to safeguard the public interest in all land suited to silviculture. Stress was laid on this point so far back as the appointment of the Deer Forests Commission by Sir George Trevelyan, of which I refused the Chairmanship, because the Secretary for Scotland could not be induced to extend the scope of the inquiry to include afforestation, which I regarded as the most important subject that could come under review. Things have moved on a little since then, but even at this moment the Small Landholders Bill renders an immediate investigation more urgent than ever, since sporting lands and grazings, once subdivided, and farms having fixity of tenure, would, so far as these may be suited to afforestation, be definitely lost to our prospective forest area. The great mistake made in Ireland at the time of the Land Purchase Acts, in excluding from their scope all reservations for forests, should not be repeated here. A great opportunity was then lost for the creation of national forests in Ireland. A Departmental Committee on Irish Forestry is now proceeding to consider—

(1) The present provision for State aid to forestry in Ireland;
(2) The means whereby, in connection with the operation of the Land Purchase Acts, existing woods may be preserved, and land suitable for forestry acquired for public purposes; and
(3) The financial and other provisions required for a comprehensive scheme of afforestation in Ireland.

But it is to be feared that under present conditions there is little scope for afforestation in Ireland. Important, however, as silviculture might have been to the prosperity of

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Ireland, it must always have been a minor consideration there as compared with its importance to Scotland, and what was a regrettable oversight in the case of Ireland would be a fatal error in any scheme for the solution of the Scottish land question; for with us afforestation is the crux of the whole problem, in that it is by far the surest way to increase the landward population. A policy to provide work ultimately for two or three hundred thousand men surely comes before one for creating a few score, or even a few hundred, of small farms. At anyrate, the alternative should be placed before the country, for if the whole of the Highlands was divided into small farms, it would add very little, if at all, to its existing population. Plant the Highlands, and the number of its people would double. Captain Sinclair provided that one of the three agricultural commissioners under his Bill should be a person skilled in forestry, but the Bill characteristically made no provision whatever whereby this skilled person could turn his knowledge to practical use. He was unprovided with staff, location, or funds; he was to be a mere name and cipher. Nothing could have come of this insertion of words in a project of law.

The proposed land Court had the widest powers to assume control of land at its own valuation for "experiment" in small farms; it was expressly debarred from purchase, which is sufficient evidence that the Government had never given the least practical consideration to forestry. For whatever the effects of divided ownership in agricultural occupation, it has not yet been advocated either as a panacea for the ills of silviculture or as a possible form of tenure for State forests. The effect of the Bill, were it to pass, which, fortunately, is not probable, would be to exclude all lands now allocated as outruns from any future scheme of State afforestation. Such moorland would carry no more population whether it were under the stock of a large or small farmer, but under timber it would support thirty or forty times the number of men it can now employ. To schedule land suited to silviculture is an essential preliminary to any real social and economic land policy in Scotland, and therefore we should press this consideration upon the country with all the force at our command. Unless that be done, and done quickly, there is grave risk that some haphazard reversion to eighteenth-century

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methods of cultivation will involve prospective forestry, no less than our existing agriculture, in a common ruin. Owners and occupiers who are making good use of their land should, under a national scheme of forestry, remain undisturbed so far as is consistent with the public interest. But it may be roughly assumed that all heather land and rough pasture not needed for the well-being of existing small holdings, and rented under, say, 3s. an acre, which, under timber, is likely to yield twice as much, or more, should be scheduled for afforestation. Were a Board of Forestry entrusted with control, it could take over Inverliever, and undertake any future extensions on the same lines. It could select and carry out a demonstration forest. It could organise a forest school, and, taking over technical forestry education from the Education Department, which is not the proper department to administer it, it could supervise or assist in developing a complete system of forestry training, from the primary school to the university. This Board should be entrusted with the duty of safeguarding the public interest in lands suited to, but unutilised for timber growing; with the purchase of land and the organisation of State forests; with the establishment of demonstration or observation State forests and affiliated technical establishments, forest gardens and plots; while it should be consulted by the Education Department as to the curriculum in all schools in forest districts.

The Board should consist, at its inception, of a forest expert, aided by assessors to advise in the purchase or scheduling of land, and by a strong Advisory Council, for which the R.S.A.S. could present a fair choice of candidates. Later on the Board would develop, but at first the whole cost need not exceed two or three thousand a year.

As regards our Society—its branches have already achieved a notable success at Inverness and Aberdeen. It would be well if another branch or two could be formed. British lecturers in forestry are now an important group, from whom we expect much. A joint summer excursion for the English, Scottish, and Irish Societies, attended by them, with full opportunities for conference, would stimulate concerted action.

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5. State Afforestation in Scotland.[1]

By Lieut.-Colonel F. BAILEY.

The recent purchase by the Government of the estate of Inverliever, in Argyllshire, which, it may be hoped, is the first step in a scheme of State afforestation in the Highlands of Scotland, is a measure of great national importance.

In course of time this State forest, which, when fully developed, will cover an area of some 12,000 acres, will afford a much-needed object-lesson to private landowners in the growing of timber on business lines, with profit as the sole object of management; and a practical illustration will shortly there be given of the manner in which, according to expert opinion based on the results obtained in neighbouring countries, the formation of timber-crops raised with that object should be undertaken, and in which the young crops should be managed during the early stages of their growth.

It is true that full proof of the success attainable under the system followed on the Government estate cannot be afforded until a generation of trees has been raised thereon. And in the absence of such proof, or at least of practical demonstration of the methods which, applied uninterruptedly through all stages of a crop's progress, yield satisfactory results elsewhere, no real advance in the general development and extension of our own woodlands can be hoped for. Nor is this surprising; for proprietors can hardly be expected to embark their capital in schemes of planting which extend beyond the limits of their present aims, and which may indeed in some cases run counter to the exacting requirements of sport and amenity, until they have become convinced that such schemes offer a sufficiently good prospect of financial success.

But a number of landowners have now, by accompanying excursions of the Forestry Societies or otherwise, personally studied on both French and German soil the results achieved by the practice of systematic forestry in those countries; and some at least among them are doubtless sufficiently convinced of the potentialities of forestry at home to render them willing to make a start, if an example of such work were available here for more prolonged study by themselves and their employees; and

[1] Reprinted from the *Scotsman* of 8th November.

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particularly so if they could be shown how to deal with a portion at least of their existing woods (which have, for the most part, been raised with objects other than that of profit), so as to secure the best results now obtainable from them.

Demonstration in the latter, and very important, branch of the business cannot be given at Inverliever, because the crops growing there are too small in extent, and are not sufficiently varied in nature and condition. For this and the other purposes that have been so often set forth, it is necessary to provide accessibly-situated Demonstration Forests, which should include considerable areas of growing woods, of species and ages as varied as possible. The State alone is competent to own and control forests maintained for these objects, as on privately owned estates there is no security for that continuity of aim and action which is essential to the evolution of a crop of high-class timber-trees of ages running from 80 to 130 years. Two Demonstration Forests are required; one in the Lowlands, where "hardwoods" would form the principal crop, and another in the Highlands, where the stock would be mainly conifers.

The acquisition by the Government of these two areas, in addition to Inverliever and its hoped-for extensions, could not fail to give a powerful impulse to the development of forestry on private estates in this country. And as work of a very interesting nature could at once be undertaken in the existing crops, the Demonstration Forests would also provide the means of imparting practical instruction to students of the science from our University and other classes. Relatively brief visits by them to Continental forests, for study of the results there obtained, might shortly be substituted for the longer periods occupied in practical work abroad, which, until our State-raised crops become fully developed, will, unfortunately, be necessary for the instruction of the students in our advanced classes.

The State forests will be worked on a purely commercial basis, as an investment made for profit; and the management will be conducted with full knowledge of the methods of treatment which have succeeded in other and neighbouring countries. An accurate record will, from the very beginning, be kept of all work done, as well as of all expenditure incurred, and of all yield in material and money. This record, which, as a matter of course, will be available to those interested in it, will without doubt prove to the landowner that his woods may be made by

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no means the least profitable part of his estate, and will, it may be hoped, render him willing to spend such available sums as may be required for their gradual development. It is true that in doing this the individual owner of to-day is, in most cases, sowing what he will not reap. But most proprietors are probably able to do something, at least on a moderate scale, towards the improvement of their family estates; and the stocking, *annually without intermission during the period of possession by each successive owner, of even a small area of constant amount*, would be a step in that direction, which might be taken without the imposition of an insupportable burden.

The ground and the species should be selected under competent professional advice; and the work should be carried on year after year until a forest composed of a series of similarly constituted crops, of regularly graduated ages, and standing on equal areas, has been formed. It would be a great advantage if the future forest could lie in one continuous block, though this is not an absolute necessity. The reason is that large blocks of forest are much to be preferred to smaller ones, because, in their case, the trees affording mutual shelter, develop better; the length of fencing and its cost per acre vary inversely with the extent of the area enclosed; fewer roads are needed; work is more concentrated, and is consequently cheaper, and more easily and completely supervised. If, for example, a proprietor had decided that he could annually plant out an area of 10 acres, and if 80 years were required to bring the crop to its most profitable dimensions, the total area of the future forest would be 800 acres; and so for every additional 10 acres which could be undertaken annually. It would, as a matter of course, be essential that the proprietor should make such a record of his scheme as would enable his successors to go on with it.

When once the suggested forest has been fully constituted, the owner, who will restock the ground as it is cleared, certainly continues to sow what he will not reap; but, on the other hand, he reaps what he did not sow, for year by year he will cut a full-grown crop, which had been planted by one or other of his predecessors, and in the case of crops which are to stand long enough to yield large timber, thinnings which can at least pay all annual outlay, will become silviculturally desirable, long before the felling age has been reached. Many proprietors appear to shrink from undertaking afforestation, because they

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think it necessarily involves extensive operations with the immediate outlay of an amount of capital that they are not prepared to lay down. But if, having convinced themselves of the financial soundness of afforestation work, which they cannot do otherwise than through an example set before them by the State, they were to act as above suggested, an important extension of the industry would shortly become apparent.

No doubt a portion of the State Demonstration Forests would be set apart for experimental and educational work having more than a merely local interest, which the Government officers would conduct for the benefit of the country generally. In this section of the estate the object of management would differ entirely from that governing work in the main forest, in that it would not be expected to yield a money profit; and its records would consequently be separately kept.

The Royal Scottish Arboricultural Society has, for many years past, persistently urged the provision of a State Demonstration Forest, and it may be hoped that the important step now taken by the Government will shortly be followed by the acquisition of additional areas, more accessibly situated, and otherwise more suitable than Inverliever, for the educational and other purposes above indicated.

A point which will early become interesting is the effect that the starting of planting on a considerable scale in the Argyllshire Highlands will have in connection with the rural labour question. As sufficient local labour is not likely to be available, an opportunity will at once be afforded of putting to the test the suggestions recently made by Dr Schlich and others, for giving forest work to a portion of the army of the unemployed. But it is certain that the forest will require a large number of permanent workers, while the inauguration of systematic forestry is invariably followed by the development of various wood-using industries, which through it secure an unfailing supply of the necessary raw material; and it may confidently be expected that before the lapse of many years, a considerable resident population will have established itself within and around the new forest. The effect of the forest in this direction is likely to be more important and far-reaching than in that of providing casual work for the unemployed.

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6. The Douglas Fir as a Commercial Timber-Tree.

(With Two Plates.)

By JOHN D. CROZIER.

It is now eighty years since the Douglas fir was first introduced into Britain, and although during the first forty years or so of its existence in the country it was not generally recognised as an economic species, the latter half of that period witnessed a remarkable forward movement in the estimation of planters regarding the suitability of the tree for cultivation for profit.

At the date of its introduction, no doubt, the timber of the larch had come to be appraised at its true value, and planters could hardly be expected to launch out on large experiments with a new and comparatively unknown tree. Still the planting of Douglas fir went steadily on; and when, in later years, the larch showed unmistakable signs of deterioration, and the question of a more reliable substitute forced itself on the attention of those connected with woodlands, the Douglas fir was thought by many to be the only tree capable of filling the breach. Certainly no other tree, native or imported, possessed in so remarkable a degree the characteristics necessary to place it at the head of our list of coniferous timber-trees. Possessed of a robust constitution, a first class quality of timber, and a power of adaptation to soils and situations possessed by few other trees, the good opinion formed of the tree by early planters is not likely to be belied by the results of later experience.

A native of western North America, where many of our most promising exotics are found indigenous, and where also much of the lower flora is identical with that of Britain, showing the similarity of the climate of the two countries, it is found over an area of about fifty thousand square miles, and is perhaps the most widely distributed of all the American trees. It is found in the higher reaches of the Fraser river and the Cascadé Mountains, in latitude 55°. From thence it extends along the coast and Rocky Mountain ranges to a point in Mexico, just within the northern Tropic. At its northern limit the climate is moist and the rainfall heavy; while at its southern extremity the climate is dry and arid, and the sunshine almost perpetual.

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It is supposed to reach its highest state of development in the State of Oregon and Western Washington, and in the moist regions around Puget Sound, where specimens of 300 feet in height and 27 feet in circumference have been recorded. On the eastern (or Atlantic) slope of the Rocky Mountains, where the rainfall is light and the drying easterly winds especially severe, the tree, naturally, does not attain to those gigantic dimensions. Under the most favourable conditions in the foothills and valleys, its size limit is stated at 150 feet in height and 9 feet to 12 feet in girth. It reaches its greatest altitude in Colorado, where it clothes the mountain sides to a height of 11,000 feet, but at that extreme elevation it has been dwarfed by exposure to a mere bush of 3 or 4 feet in height. It will therefore be seen that in its native habitat the Douglas fir is subjected to extremes of heat and cold, moisture and drought, elevation and scorching winds, such as in Britain it would be impossible to find a parallel to; and when we further take into consideration the magnitude of the area over which it is found indigenous, the comparison shows all the more strongly the extraordinary accommodative nature of the tree.

The experience gained of the tree in Britain proves its partiality to the hills and valleys rather than to the open plains or plateaux, and no doubt when planted in the former positions its tendency towards great height-growth will be most fully taken advantage of. It is not too exacting as to depth or quality of soil, provided the subsoil is deep and porous and the drainage efficient, but an undrained soil is fatal.

The genus, which consists of only one species, is represented by several geographically well-defined forms or varieties,[1] but for the purposes of this paper it will be necessary to deal with two of these only, the "green" or "Oregon," and the "glaucous," which, by common consent, we speak of as the Colorado variety. That these two varieties have not been sufficiently differentiated from a commercial point of view is a fact only too well known, and has been the cause of much disappointment. They are, however, easily distinguished, both by the form of the trees and the colour of their foliage, and by the

[1] In reference to this point, Prof. Balfour, Hon. Botanist, writes: "Some of these are regarded by modern writers as of specific rank. Mayr, for instance, recognises four species in the genus."—HON. ED.

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Plate VI.

DOUGLAS FIR (Colorado Variety). DOUGLAS FIR (Oregon Variety). NORWAY SPRUCE.

Specimens from seven years old plantation—from date of planting. The Colorado Variety and the Norway Spruce were five years old when planted, and the Oregon Variety three years old. Their respective heights are now: Colorado Variety, 8 ft. 10 ins.; Oregon Variety, 15 ft. 6 ins.; Norway Spruce, 10 ft. 11 ins.

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difference in their cones, as may be seen from the accompanying photograph. (Fig. 3 Plate VII.)

On the estate of Durris, Kincardineshire, the Deeside property of Henry Robert Baird, Esq., the Douglas fir was first planted about seventy-two years ago, and since that date it has been reared and planted out on a more extensive scale than on any other estate in Britain. The original tree has now reached a height of 114 feet, girths 12 feet 6 inches at 5 feet above ground-level, and contains over 300 cubic feet of timber. It is, of course, of the green or Oregon variety.

The Colorado tree was not introduced until about thirty to thirty-five years later, but about that date considerable numbers were planted in admixture with Scots pine and spruce in various parts of the estate. It has not, however, proved a success as a timber-tree, being considerably slower in growth than either of the species with which it had been mixed, and in many cases it has been quite suppressed before reaching its thirtieth year. These results are being verified by later experiments, but its suppression seems destined to take place at an even earlier age. As a commercial tree, it is of no account in our climate, but it is capable of withstanding severe exposure, transplants well, and is quite frost-hardy. Its principal uses will probably be found in the formation of shelter-belts, and for planting in those positions where it is not desirable to see trees of large stature.

In the Douglas fir of Oregon, however, we have a tree of a totally different character, and one which, after an extended trial, has proved its suitability for all practical purposes. On the estate already mentioned, occupying the northern slope of the eastern extremities of the Grampian Hills, the plantations rise from 100 feet to 900 feet elevation, but these are backed up, towards the western part of the estate, by a still higher range of hills, which in a measure tends to break the severity of the gales which blow from that direction. The soil alternates from a light loam overlying gravel, in the valley of the Dee, to a gritty boulder clay, in parts mixed with peat, at the higher elevations, and overlies gneiss, the principal geological formation of the locality. The Douglas fir has been tested on all classes of soil, and at elevations varying from the lowest up to the highest point, and in no case has it failed to make satisfactory headway. At an altitude of 850 feet, it may be seen,

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accompanied by *Picea sitchensis* only, racing away from larch, spruce, and Scots pine. While averse to moisture in the soil, a considerable amount of humidity in the atmosphere is certainly beneficial to the tree. The average annual rainfall on the low ground amounts to 35 inches, and the aspect being northerly, the air is cool and moist; but a very considerable increase in the amount of rainfall above stated would, I feel convinced, give a correspondingly good result on the growth of the tree. On good forest soil it is no infrequent occurrence to see trees in the pole stage making growths of 4 feet and upwards in the course of a single season. This rapid growth, however, is not maintained for long; but under favourable conditions an average annual growth of about 2 feet would seem to be well within the possibilities of the tree up to its sixtieth year.

In North America the timber is known as Oregon and Columbian pine, and exported under those names. According to the author of *The Forests of Canada*, it is used for almost every purpose, from wharf- and ship-building down to the manufacture of household furniture, and, owing to its great durability when air is excluded, it is especially valuable for pile work in the building of bridges. The average cut per acre is calculated at 50,000 cubic feet, and as all trees above 5 feet diameter and below 2 feet are not included in the cut, it would be interesting to know the limit of production. Whether under cultivation in this country it will ever approach either the volume or the value attained in its native habitat, is a question frequently asked, but which it would be idle to speculate upon. In the first place, the requirements of our home trade do not demand a heavy class of timber, and secondly, no one would consider a rotation based on the period required to bring those trees to their matured state within the limits of practical forestry. Any comparison, however, between the quality of the home-grown and foreign Douglas fir must, in the meantime, be greatly to the disadvantage of the former, as while the oldest trees in Britain are still in an immature state, the imported timber usually is the product of several centuries growth.

In appearance the timber of home growth resembles larch, but in a young state it is not possessed of the density and toughness of fibre of that timber. For standing in contact

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with soil, and for such purposes as gate-making, fencing, etc., where the ability to stand tear and wear is a desideratum, it is inferior to larch, but there are many other purposes for which it is infinitely superior, and for the supply of which a much greater volume of timber is required. For constructive purposes of all kinds it is especially suited, and, owing to the beauty of its grain and the ease with which it can be worked, it is valuable for the finished work of interiors. The timber stains well, and, when varnished, takes on and retains a beautiful gloss. Outlying and badly grown trees, when sawn up, are liable to warp, but this defect is not apparent when dealing with trees of clean straight growth, and with home timber more freedom may be used in regard to nailing. In a younger state the timber has been tried and found useful as curing-barrel staves and heading, and for box wood, for which, in this locality, there is an unlimited demand.

What the most profitable length of rotation may be is a question which will have to be determined by trade demands, but to provide timber of a class, fitted for house construction, any period short of one hundred years need not, I feel convinced, be contemplated, and on deep rich soils probably other ten or twenty years will require to be added to that period. No doubt trees of sufficient size to produce beams and scantlings of any size desired may be grown in fifty to sixty years, but it would be nonsensical to speak of timber of that age as matured, and, judging by the vigorous state of the oldest trees in the country, the prospects are that a long rotation may yield better financial returns than a short one.

For simple high-forest, pure cropping will be found in every way the most practical system. In mixed plantations an even height cannot possibly be maintained, owing to the dominating character of the Douglas fir, and the canopy, which in its case is always necessary to check the growth of the persistent side branches, cannot be kept intact. Formerly the high price of seeds and plants was a sufficient bar to pure planting on an extensive scale, but now that seedling Douglas fir may be purchased at prices not greatly in excess of those ruling for other coniferous forest trees, pure planting is quite defensible on economic grounds, and at any rate, any saving effected in the planting, by mixing with other trees, will be more than lost sight of in the cost of pruning, which at a subsequent date will

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become necessary. Another advantage gained in pure plantations is, that the danger of loss or deflection of the leading shoot by winds, frequently noticeable in mixed plantations on exposed sites, is nowhere apparent when dealing with the tree planted and cultivated on common-sense principles.

It would be matter for surprise, indeed, were any result other than that of disappointment to follow the directions frequently laid down for the planting of the Douglas fir in a mixture of other trees; but should a mixed plantation for any reason be decided upon, and the Douglas fir still be regarded as the permanent crop, a distance of more than 6 feet apart should not be contemplated, and the interspaces should be filled up to 3 feet over all with Norway spruce, which seems about the only tree suitable for the purpose.

In that case, 1210 Douglas firs would be required per acre as standard trees, and with the matrix composed of 3630 Norway spruce, the cost of planting, where the plants had been purchased of a size sufficiently large to enable them to be put directly out to the forest, would be considerably lessened.

As no area of pure Douglas fir in this country has yet reached maturity, statements purporting to show the volume and value of pure crops must be regarded as somewhat hypothetical. There can be no doubt, however, that yield tables dealing with the ordinary coniferous forest trees help us but little in arriving at a true estimate of its productive capacity. As a result of measurements taken in various parts of the estate, and under varying conditions, I found that the increase over spruce in cubical contents was never less than 50 per cent., frequently 75 per cent., and in some cases as high as 120 per cent.—the higher percentage showing at the higher altitudes. As regards Scots pine, the increase was more pronounced, varying from 150 per cent. to 200 per cent. Those figures represent the mean of a number of measurements taken in each plantation, and the trees selected were as nearly as possible an average of their kinds.

The Douglas fir plantation at Taymount is perhaps the oldest pure wood of the species in this country, and it has at different periods been dealt with by forestry experts. In 1888, the plantation then being only 28 years of age, Dr Schlich estimated the volume at 2956 cubic feet per acre, quarter-girth measurement. In the winter of 1899 and spring of 1900

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Dr Nisbet shows in *Our Woods and Forests*, page 208, that the plantation had increased to 4850 cubic feet per acre; while in 1903, or after only three years' growth, Dr Somerville in the *Transactions*, Vol. XVII. page 273, calculates the contents per acre to have reached the enormous total of 7977 cubic feet. Either Dr Somerville's estimate would appear too high or Dr Nisbet's too low, as, judging by the rate of increment between the years 1888 and 1900, the three years between 1900 and 1903 could hardly have been responsible for an addition of 3127 cubic feet per acre.

As a pit-wood tree the Douglas fir is well adapted, and is deserving of consideration wherever crops cultivated for that purpose are found to pay. Crowded together in pure plantation, by the time they have reached their thirtieth year they will be found capable of yielding an amount of pit-wood almost incredible to those who have not seen the tree so grown. For this purpose the planting should be done at not more than 3 feet apart, as otherwise a gross basal growth and a too branching stem will certainly follow.

While not a suitable tree for mixing with other species of even age, the Douglas fir may with great advantage be introduced as an under-crop in older oak and larch plantations. In this respect it has no rival amongst conifers, taking into consideration the value and volume of the timber it is capable of producing under the shade of other trees. As the result of experiments conducted on this estate, now of thirty years standing, its superiority over spruce and silver fir has been abundantly proved. Where both of those species have failed, either as the result of attack by aphis or too dense shading, the Douglas fir has grown into useful timber. In comparison with beech as the shade-bearer, the latter probably is preferable, owing to the greater amount of organic matter it is capable of depositing on the ground, but as beech timber is of comparatively little value, better financial results may be anticipated from the planting of the former. Excellent examples of the beneficial results obtained by underplanting larch with both beech and Douglas fir may here be seen, but no apparent advantage has been gained by the use of the former over the latter. The soil in both cases has been greatly improved, and the overhead larches have increased in volume over the parts not so treated to an almost incredible extent.

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Underplanting larch woods with Douglas fir should not preferably be delayed beyond the thirtieth year, as the danger of too long delay may be experienced in the unlooked for decay of the larches before the Douglas firs have reached a marketable size. All the suppressed and weakly stems should have been previously removed, and from 500 to 600 standards will be sufficient to leave per acre. The size of the Douglas plants to be used in the operation must be determined by local conditions, but if no danger is to be apprehended from ground game, 2- or 3-year-old seedlings may be used and planted by the dibbling-iron, a cheap and efficient process.

April we find by experience to be the most favourable month for planting, and for general use 2-year seedlings 1-year transplanted give the best results. These may be planted either by pitting or notching, but the latter method, in our moist climate, and when carefully done, is quite satisfactory. The distance at which they are put in is usually from 3 to 3½ feet. In ground covered with a rank growth of bracken, pits are opened at 4 feet apart, and a larger class of plant used. With a little attention for the first two years after planting, the Douglas firs rapidly assert themselves, and in a few years are capable of suppressing the rankest growth.

When thinning operations become necessary they must be conducted with a light hand, the aim being always to keep the ground as heavily stocked as possible, without endangering the health of the plantation, until it has reached its maximum of height-growth, in order to promote branch-shedding and to guard against damage by gales.

As regards the reproductive capacity of the Douglas fir, it leaves little to be desired. Indeed, its early reproductive features were regarded by some as a sure sign of early decay, but this belief has now been dissipated.

Trees of about 15 years of age, if occupying an open, sunny position, may be depended upon to produce a supply of good seed, but from 30 to 50 years may be regarded as the most fertile period. As an illustration of this fertility, I had the produce of an outlying specimen tree 40 years of age counted, and found that the total number of cones amounted to over 15,000. The tree was branched to the ground, and even the lowest tier was thickly covered with cones. There is no rule by which a good seed-harvest may be foretold. The bloom, which

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shows itself somewhat precociously in our climate, is frequently nipped by late frosts, otherwise every second or third year might be depended upon for a supply. Like the larch, there is a red and a white flowered variety, but whether there is an accompanying variation in the quality of the timber, I have not been able to ascertain. The white variety may be distinguished by the lighter colour of its leaves and its more spreading habit. As a timber-tree it is inferior to the red variety, but it is also less common. The cones ripen in the beginning of October, and they should then be collected without delay, as in presence of drying winds the scales open and the seed is shed. After storage in a dry loft during the winter, the cones, if the quantity is not too large, may be exposed to sun-heat, and the seeds extracted in that way. In the beginning of May the seeds should be sown out in well-prepared beds 3 or 3½ feet in width, 1 lb. of seed being allowed to every 8 or 10 lineal yards. Much depends, however, on the quality of the seed, and in purchasing, a guarantee as to the germinative capacity and the source from which it has originated should be demanded. It has been the practice of some seed firms in the eastern States of America to supply seeds of the Colorado variety when the other had not been specially mentioned, and this, not from dishonest motives, but because the glaucous variety is in those parts regarded as of the two much the hardier and more reliable tree. Where the collection of the seed is under control, much may be accomplished in the improvement of the type of the tree commercially. The tendency to sport as regards shape of bole, branch formation, and shade of colour, is a specially noticeable feature of the tree. Two trees may be seen growing closely together in the plantation, the one possessed of a mast-like stem and practically devoid of branches, while the other, whose branches may shoot out at an upward angle, is still clothed to the ground, and as a timber-tree presents a most forbidding appearance. Obviously the seeds of such trees as the latter type should not be collected, but may be left as fit food for the squirrels, which are specially fond of them. That seedlings inherit to a certain extent the characteristics of the parent is an admitted fact, and, as a result of this knowledge, no one would willingly select trees with a badly developed stem, or which possessed other undesirable features, as the standard or mother-tree for natural reproduction. If this careful selection, then, is necessary in the one case it is no less

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so in the other, and especially as regards the Douglas fir in its present unfixed type. While the horticulturist has by persistent endeavour, from his point of view, improved the standard of almost every plant under his charge, comparatively little has been done in an endeavour to improve the type of our timber-trees, or even to preserve their best features.

To attack by insects and fungi the tree is not immune, although less subject than our native and longer introduced trees. In the nursery, *Botrytis Douglasii* is responsible for the killing back of a few young shoots, and *Phoma Douglasii* at a later stage occasionally attacks the stems of the tree, but the real damage to be guarded against is that caused by *Agaricus melleus* and *Trametes radiciperda*, which attack the trees after being planted out in the forest. On old clearings, or when underplanted in old hardwood plantations, they are likely to be most destructive. Another fungus, *Aecidium coruscans*, which I believe has not previously been observed in this country, or mentioned in scientific literature as attacking the Douglas fir, I found in a few young plants in the nursery some time ago. It is a species of rust-fungus, and is stated by Hartig to be common on the spruce in Sweden and Finland. (See Fig. 2 Plate VII.)

As regards insect pests, the pine weevil, *Hylobius abietis*, seems to be the only cause of damage to the tree, but with proper precautions injury from this source can be easily avoided. *Megastigmus spermotrophus*, a species of the *Cynipidæ* or Gall wasps, is occasionally destructive to the seeds, but its life-history is still under investigation, and it is to be hoped that some means of overcoming its attack may be devised.

The practical experience gained of the Douglas fir in this country points it out as one of the most valuable timber-trees ever introduced, and when its suitability for commercial purposes has been fully realised, there can be no doubt it will be one of the most largely planted of all our timber-trees.

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FIG. 2.

AECIDIUM CORUSCANS ON DOUGLAS FIR (DRIED SPECIMEN).

The leaves and branches below point of attack have developed normally, while above the leaves are short and

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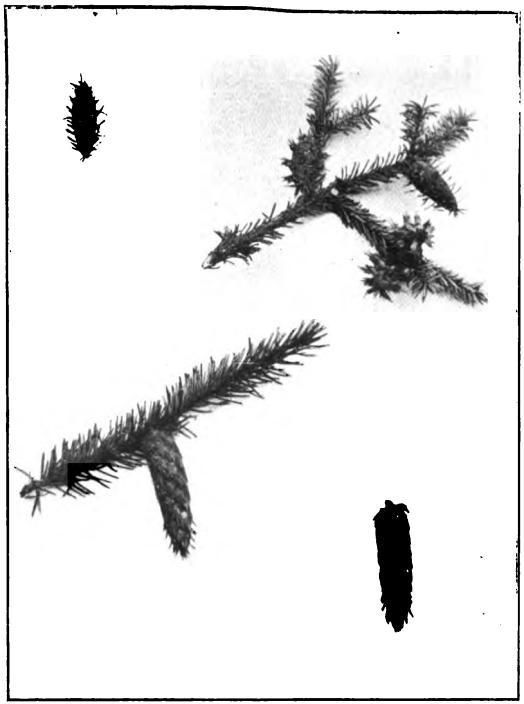

FIG. 3.

CONES OF THE COLORADO AND OREGON VARIETIES OF THE DOUGLAS FIR.

The cone of the former (see upper part of figure) is smaller and more evenly conical, and has its bracts more

PLATE VII.

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7. The Nursery Treatment of the Western or Californian Hemlock Spruce.

By J. M. MURRAY.

The Western Hemlock Spruce (*Tsuga mertensiana*, Carr) has hitherto been looked upon only as one of our finest ornamental species, but, judging from its habit and rate of growth, it may also come into consideration as being likely to form a valuable forest-tree in Britain.

The only objection that can be fairly urged against the general and liberal use of this tree for planting, is the exorbitant price asked by nurserymen for the plants. This price is no doubt determined to a great extent by the scarcity and dearness of seed. Along with this, there is the difficulty experienced in rearing the plants. But the scarcity of seed is not likely to be long continued, since we have now in this country trees which bear seed freely. As a proof of the fertility of these seeds when in a favourable situation, thousands of natural-grown seedlings may be seen springing up. Also, judging by experience, it is reasonable to believe that plants produced from home-grown seed will be better adapted to our climate than those of foreign origin.

While employed on an estate in Perthshire, I had considerable experience in rearing the Western Hemlock spruce, more popularly known to arboriculturists as *Abies albertiana*, the Albert spruce.

On this estate many thousands were reared from home-collected seeds, and I will now endeavour to explain the chief points to be attended to in raising the plants.

It is during the earlier stages of growth that the greatest care must be taken, since then the plants are, as compared with other forest-trees, somewhat tender.

The cones become ripe in October, and the seed may be easily extracted, but a few hours in a kiln will be of great assistance in bursting the cones.

The germinating power of the seed is equal to that of the Douglas fir. The seeds should be sown about the end of April, and as they are very small, care must be taken not to sow too thickly. The covering on the seeds must not be too heavy, barely a quarter of an inch being sufficient.

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Most of the plants were reared in an open border, but some were also reared in propagating-boxes in a cold frame.

With the fostering influence of a better soil, the finest plants were certainly raised in the latter manner, but with more expense than the former. Where only a few thousands are wanted, and the necessary attention can be given, I should certainly recommend the raising of the plants for a time in boxes under glass. Germination takes place in about twenty-one days after sowing. Protection must be then given against small birds, such as finches, which seem to be very partial to the newly germinated seedlings.

Very great care must also be taken at this stage as regards watering and shading; in fact, on this to a great extent the welfare of the crop depends. For several weeks the young plants should not be exposed to the direct rays of the sun.

To prevent this, the plants should be shaded with a light covering of tiffany. This may be supported on a light framework, about 12 inches above the plants. A convenient method is to run two wires through the tiffany and fix them to the framework, thus making it convenient to slip the material off and on. This shading should be kept off at night and on dull, sunless days, and only put on during bright sunshine.

The next point in regard to which great care must be taken, is in watering. Overhead watering must always be avoided as much as possible. In the case of plants in boxes, it is much better to immerse the box in a trough of water about once a fortnight. Where overhead watering has to be done, it should be done during the afternoon, and never at night. When watering is done at night, damping off is more liable to occur.

Plants reared in the open should be protected against frost during the first winter at least. In the first year their tops do not always get sufficiently matured to withstand frost, and also at this age the plants are apt to be thrown out by alternate frost and thaw.

A method of protection which I have seen used was to place rough boarding on the framework previously erected for the tiffany. This also affords a protection against snow, and the covering can be taken off on fine days. The plants reared in boxes may be protected in the same way.

It is better to defer transplanting until the plants are two years

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old, as by this means they can be protected, if necessary, during two successive winters.

The full cost of rearing under this method (*i.e.*, in an open border) does not exceed 5s. per thousand for two-year seedlings, and the after treatment required is similar to that used for the larch, Scots pine, or spruce. This being so, it may be reasonably expected that the price of full-grown plants of *Tsuga mertensiana*, grown from home-collected seed, should not much exceed the price of larch, etc.

The Western Hemlock spruce requires a situation moderately sheltered, but will grow on any friable soil free from stagnant water. It also seems to delight in a little side-shade.

When young, the tree has a very striking and graceful appearance. The leading shoot and the extreme points of the lateral branches are always pendulous, and the tree resembles somewhat in habit *Cedrus deodara*. Its growth, however, is much more rapid than in that species, for it attains a height of over 85 feet in 46 years, with a trunk fully 7 feet in circumference at 5 feet from the ground.

The durability of the timber of British growth has not yet been ascertained, but that which I have seen cut up, although of young growth, appeared to be hard, tough and close-grained. To all appearance the wood seems to be as useful and durable as either the Scots pine or the common spruce, and it is not so readily affected by heart-rot as the last-named. Except, however, in very favourable situations, I would not recommend its use as the ruling species in a plantation. As a dependent species in a mixture with other conifers there are few sites or soils on which it will not thrive. In rate of growth, so far as I have seen, it exceeds that of the common spruce. Although the plants are somewhat tender during the first two or three years' growth, after that age they are quite hardy. On account of this, it is best to defer planting till they are about four years old, when they will be from 24 to 30 inches high. The time for planting should also be considered, and the greatest success is got by late spring planting.

It is hoped that the foregoing notes may be of some assistance to those interested in the rearing of this species.

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8. The Cultivation of Hardwoods.

By J. Boyd.

In submitting the following remarks regarding the cultivation of hardwoods, I do so with diffidence, yet with the conviction, which has grown on me, that very many of our hardwood plantations have suffered permanently through the very common practice of mixing the broad-leaved trees with conifers. It has been my lot to have had something to do with such woods during all my experience in forestry, and the result of that experience, and of observations elsewhere, is that, rightly or wrongly, I have arrived at the conclusion that, generally speaking, the practice is wrong, and that, unless under exceptional circumstances or special conditions, hardwoods should be grown by themselves, and conifers likewise.

Plantations, created under the system referred to, have usually a certain number of hardwoods planted out by single trees in lines, at distances apart varying from about 6 to 15 or 16 feet, there being generally a mixture of four or five kinds of hardwood trees, and the intervening spaces being filled in with another mixture of three, or probably four, kinds of conifers. All the trees are more or less of an even age. The result is, not a mixed wood, but a very complex mixture of trees, which is very difficult to manage. Of course, the conifers are only supposed to be retained on the ground for a short period, as nurses, to draw up the others into clean, straight stems, and this, in itself, entails a considerable amount of extra attention and expense in the management, if the woods are ever to have a chance of attaining the end for which they have been formed. Even with the best possible attention it is a very difficult task, and sometimes an impossible one, to keep the woods as dense as they ought to be, and, at the same time, to preserve the hardwoods. Not infrequently, indeed, does it happen that a large proportion of the nurses have to be removed so early—to prevent the permanent trees from being overtopped — that the canopy is destroyed, with the result that instead of the hardwoods being drawn up into clean straight stems, the very opposite takes place. The extra space given, through the removal of the nurses, encourages an increased lateral growth at the expense of

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the desired growth in height; and so much is this the case, that in middle life the ground may become stocked with trees having short stems, large crowns, affording an unsatisfactory canopy, and with an undergrowth of all manner of herbage, all of which conditions are—as is well known—opposed to good results. In the end, when the final crop is removed, the return will be very far short of what the locality was capable of producing had the ground been properly stocked and the crop properly managed, or even had the ground been properly stocked and the crop left to nature. Further, in all probability, the soil will have seriously deteriorated, and have been rendered unfit for restocking with anything but trees of an inferior class. If this is the result obtained by the system with an expensive management, it is surely proof that there is something very far wrong with it. It may be argued, however, that the fault is not in the system, but in the management; and that, if the crop had been left to itself, the result would have been more satisfactory. Undoubtedly there can be no better test applied, than to allow nature a free hand, because any piece of ground if properly stocked, and left to nature until middle life, will give successful results if properly handled thereafter. In the case of such complex mixtures as are under discussion, there may be instances where nature has guided the development to a satisfactory result; but, with such a foundation to work upon, she is handicapped; and, although she can do much in the way of rectifying man's errors, there are many cases where her efforts prove ineffectual. Where such mixtures are left to nature, it will occasionally happen that the final crop is a hardwood one; but it is much more likely that in early life the conifers will gain the ascendency over the hardwoods, and, in the final crop, there will be a preponderance of the nurses on the ground. The reason of this is that the majority of the hardwoods will have been overtopped in the first fifteen or twenty years, the only exceptions being those individual trees which—on good situations—have become quickly established, and have been able to hold their own with the quick-growing conifers. Thus it is that the best nature can do gives but poor results. Instead of a hardwood crop, we have a crop of conifers with a few of the hardwoods dotted through it, a crop which, financially, may be quite as much a success as one which had received careful attention in order to preserve the hardwoods; but which is by no means a success in the true sense, because the ground

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was stocked with the object of having a crop of hardwoods, and that end has not been attained; and further, as the result is practically a crop of conifers, it was shere waste of money to plant so many of the more expensive hardwoods. The financial result, it has been admitted, may be equal to that of the hardwood crop already discussed, but then that is far short of what ought to be obtained from the soil; and, moreover, the favourable return is due not to the quality but rather to the quantity of timber produced by conifers on such a soil, the timber being almost invariably soft and inferior, and, in the case of Scots pine, unless in very old trees, being deficient in redwood. It is indeed no unusual thing to fell Scots pine trees which have grown in such localities for 90 or 100 years, and have attained a diameter of from 15 to 18 inches, and to find that they have no more than from 6 to 8 inches of heartwood. No doubt they have not reached maturity at that age, but then they would take nearly as long as oak would to reach that stage; and even then the quality of the timber would be inferior to that grown on a more suitable soil.

As regards revenue, the return from such a crop of Scots pine would not stand comparison with that obtained from a full crop of oak. Therefore if the soil is capable of growing a crop of the latter, or other valuable hardwood, it is a mistake to have it stocked with the former, except where unusual circumstances justify the growing of conifers for some express purpose, such as for pit-wood; but then, of course, there ought to be no intermixture of hardwoods.

Some reference has already been made to nature's work in rectifying man's mistakes; and it has been implied that the tendency of her work, when undisturbed, is to allow either the hardwoods or the conifers to gain the ascendency. This indicates that it is unnatural to have them growing in company; and therefore, according to the laws of nature, they should be grown apart—each class on soil and situation suited to its proper development. It would look a most unnatural and stupid proceeding to plant oak, beech, and other hardwoods amongst Scots pine on a poor, bare moorland or hill-side; and why should Scots pine and other conifers be planted amongst oak, beech, and other hardwoods on a soil and situation which is well adapted to the proper growth and cultivation of these latter. In the case of natural forests, hardwoods and conifers may be found

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overlapping to some extent, but in a general way the one class is quite distinct from the other, and it would surely be more reasonable to follow nature, than to work at cross purposes with her. Indeed, almost everything seems to be in favour of the former course; the management is simpler, the fertility of the soil is better preserved, and the financial results are more satisfactory. The chief difficulty would lie in the formation of the woods, and especially so where there is a variable soil, which is not uncommon in many localities. In such cases, a considerable amount of care and skill would be required to ensure the whole ground being stocked with trees suited to the various soils. If this were not secured, the growing of hardwoods by themselves might prove to be no more satisfactory than the mixture system. In this, as in all things, the forester, if he wishes success, must study nature and be guided by her. Indeed, at all times he should follow in the steps of nature, and assist her where necessary, but on no account should he attempt to drive her into paths of his own making.

Before concluding, it is worth while looking at some of the causes that have brought about the adoption of the system of planting hardwoods and conifers in mixtures, how these causes have taken effect, and how best they may be counteracted in the future, if already they have not been counteracted to some extent at least. If the want of means for acquiring a proper knowledge of the elementary principles of silviculture be considered one of the causes, then it may be said that this difficulty has already been removed, for the means available at the present time are so ample, that there is no reason for anyone being in ignorance of these principles, and any man who remains ignorant of them has only himself to blame; because, within the last twenty years, many thoroughly sound, practical, and scientific books have been put into circulation, and other facilities are now within the reach of all.

The very great success of the larch, on its introduction into this country, combined with its high quality as a valuable timber-producing tree, resulted in a craze for planting larch anywhere and everywhere; this probably was the chief cause for the initiation of the mixture system. Experience of the ravages of the larch disease may be said to have counteracted this practice, to some extent, as it is now well known, and generally admitted,

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that it is a mistake to plant larch except where the general conditions suit its growth; and foresters who still plant it indiscriminately are exceptional.

The difference between the cost of planting any given area with hardwoods alone, and that of planting it with a mixture, has had a great influence in promoting the system under discussion. It is a cause which still exists and will be much more difficult to overcome, because of the difference between the cost, per unit, of seedlings of the common conifers and of those of the most valuable hardwoods. This difference must always be very considerable, and is therefore likely to remain a factor in favour of mixing hardwoods with the cheaper kinds; but discretion ought to prevent this circumstance from having too great an influence. The difference in cost has, of course, been greatly increased through the depredations of ground game, which necessitate the practice of using large hardwood transplants, where, but for the existence of these pests, smaller ones would have served the purpose better, at probably less than half the cost. Not only have these enemies of forestry affected the cost of regeneration in this way, but they have, in many instances, practically wiped out the hardwoods from stretches of young plantations, and left large areas with nothing but conifers. This also has had a very considerable influence on stimulating the system of mixtures; the mixtures being planted with the idea that there is a remote chance of having a hardwood crop, but with the certainty that, if this is destroyed, there will still be a crop of some kind on the ground. It is therefore satisfactory to know that the real destructiveness of ground game, and especially of rabbits, is beginning to be realised by many landowners, and that they are being reduced to reasonable numbers, or, better still, exterminated. The removal of this cause may thus be said to be within sight, and it is hoped that the day is not far distant when 2-years hardwood seedlings, or 3-years once transplanted, may be generally used for planting-out purposes. This will reduce the cost of planting any area with pure hardwoods to about that which is incurred in planting the mixtures under the present system, and it will undoubtedly give better results. Further, with rabbits kept in their proper place, there is no reason why natural regeneration should not be greatly resorted to; and where rabbits have been abolished, or sufficiently reduced, it is simply astonishing to see how many

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seedlings appear, where formerly not a single seedling more than one year old was to be found.

The plea of returns from early thinnings is another of the props of the mixture system, but a very weak one, as too early thinning has very often been the means of doing incalculable harm to the final crop; and even apart from this, it is questionable whether such thinnings can now be justified at all, because larch was the principal tree for early thinnings, and its proneness to disease has reduced its value in that respect; and what with creosoting and other methods of wood preserving, hardwood poles are almost of equal value, for fencing and other purposes, with larch or fir thinnings.

The above causes then, which have been responsible for the prevalence of the system discussed, and which, it is maintained, are not conducive to the best results in the cultivation of hardwoods, may be held to have been removed, or to have become of minor consideration compared with the importance of producing the best quality of timber, and of making the best of the land. Indeed, if the statements herein made are correct, the causes referred to, with the exception of the nuisance of ground game, are at the present time of little or no consequence; and if the injury done by ground game were estimated at its real value throughout the entire country, there would be every possibility of a reform being achieved in silviculture in general, and in the cultivation of hardwoods in particular.

(The author proposes to continue this subject in an early issue.)

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9. The Cultivation of Osiers.

By ROBERT SINCLAIR.

The following is a brief statement of an experiment in the cultivation of osiers on the Atlantic seaboard in the island of Harris.

The soil is partly deep peat, partly a loam of peat and boulder-clay débris, and partly a poor, brashy, gravelly boulder drift of an exceptionally hungry nature. The extent of land is one-eight of an acre, the aspect is northern, and badly exposed to Atlantic blizzards from the north-west. Referring to the Board of Agriculture's leaflet on osier growing (No. 36), it would appear that all the conditions were most unfavourable.

In March 1905 the plot was planted with cuttings[1] at 30 ins. by 24 ins. (much too far apart, as the writer has since learned), and all the sets rooted very well. When the young shoots got to be about 3 or 4 feet high, a gale of two days' duration from the N.W. loosened every stool in the plot, laying over the whole crop to an angle of 45 degrees. Shortly afterwards another strong wind from the E.S.E. threw the whole lot just about as far back the other way. Needless to say the writer was in despair, and made desperate efforts to firm up the stools by tramping, but to little purpose, and the plants kept playing battledore and shuttlecock with every change of wind until the crop was cut in February of 1906.

The produce was carefully weighed, and it scaled 1022 lbs. green off the stool, plus some small bundles given away unweighed. This is just 3 tons 13 cwts. per acre, and it may be pronounced phenomenally heavy for a first cutting, even under favourable conditions in the osier districts of England.

The second crop was cut in January last (1907), and scaled 1753 lbs., or just over 6 tons 5 cwts. per acre. This year the crop looks like making at least 10 tons per acre. The experiment is being extended this year by planting out more plots with other varieties, but it is too soon to give any statement regarding results.

No account has been kept of the cost, as most of the labour has been done by the writer himself. The best results appear to be got from the use of 2-year old cuttings, costing from

[1] The author informs us that the trade name of the osier planted is Merrion osier. The staff of the Edinburgh Botanic Garden, to whom twigs were submitted, identified these as *Salix viminalis*.—HON. ED.

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9s. to 12s. per 1000, and as it takes about 17,000 to plant an acre, and, further, the fencing must be proof against all farm stock and rabbits, it is manifest that a large initial outlay must be faced, and that at least one year is (in a sense) lost waiting for revenue.

All the same, few crops pay so well, and none are so independent of weather, when once fairly established. Properly planted and cared for, osiers ought to form the mainstay of the small landholder, and need not be beneath the consideration of even the most advanced agriculturist on highly rented land. They like good land, well treated in every way. They make splendid shelter for other and more tender crops, they stand the sea blasts perfectly; those under the writer's observation here are now some 8 or 9 feet high, and have been frequently whipped by north-west blasts direct from the ocean, yet not a leaf has been removed or injured, nor are even the tender tops injured—a remarkable testimony to their value as a shelter-plant.

From a national point of view it may be presumed that silviculture will, ere long, take a very advanced place in the use of land in this country. It is fairly obvious that further depopulation over many areas is unpreventible unless by some constantly productive employment within those areas, and it is equally obvious that repopulation can only be brought about by similar means. There are vast areas of heavy rainfall within the United Kingdom of Britain and Ireland admirably adapted for the production of first class timber—that is a fact universally admitted by all who have any knowledge of the subject,—and it seems a reasonable belief that a great and comprehensive scheme of forestry, in conjunction with agriculture, horticulture, and their thousand and one allied industries, would not only go far to arrest further rural depopulation, but probably (perhaps certainly) be productive of a strong surplus population to carry on the industries of our large cities, as well as to help to stock our colonies.

In any such scheme the lowly osier deserves recognition. (1) It would yield an immediate and constant profit; (2) it would give immediate shelter; (3) it would yield an early and a rapidly increasing revenue, until the forest timber came to do so; (4) its cultivation is simple; and (5) its harvesting is independent of gales or rain.

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10. An Attack by Sawfly Larvæ.

(With Plate.)

By FRED. MOON.

On the 23rd of June 1906, while inspecting a young Scots pine and larch plantation, I found it very badly infested with sawfly larvæ, and trust the following particulars and means taken to combat the attack may be of interest.

The plantation in question is about four and a half miles S.W. from St Boswells station. The elevation is about 700 feet above sea-level. The area of the plantation is about 15½ acres. The south half is ten years old and the north half nine years.

When first noticed, the larvæ would be about three weeks hatched, and the attack was by far the most severe met with in my experience, many of the plants being simply loaded with larvæ. I at once got a Vermorel sprayer, and after a few experiments with Paris green, had 10 lbs. of this and 10 lbs. of wheat flour mixed and put up in 1 oz. packets, each packet being mixed with 3¼ gallons of water, this being the capacity of the knapsack-sprayer. The infested plants were sprayed with this mixture, the result being that after about twelve hours the insects lost their appetite, and in about three days died and shrivelled up.

The strength of the mixture was the maximum that could be used with safety. In fact, during a spell of very bright sunshine, a few of the sprayed plants were more or less scorched. This method of destruction was very efficacious, but as the water supply was from 100 to 200 yards distant, it had the disadvantage of being rather slow. I was therefore obliged to send two more men to crush the larvæ by hand. The plan adopted in the latter case was to put the infested branches into a small sack without severing them from the plant, and to rub the bag containing the larvæ between the hands, thereby crushing the pests. They could of course be crushed between gloved hands without using a bag, but the advantage of using the latter at this advanced stage of larval growth, was that it prevented the escape of large numbers which dropped off when the branch was touched.

Of the two plans tried, crushing by hand is certainly the quicker method and the most certain, as, though in this parti-

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Plate VIII.

EFFECT OF SAWFLY ON YOUNG SCOTS PINE PLANTATION.

THE SPRAYER AT WORK

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cular case spraying was most effective, still one could readily understand that heavy showers of rain following the spraying operation would be apt to wash the Paris green off.

In spite of our efforts a large number of the larvæ passed into the cocoon stage about the 20th of July. Some which I kept in captivity emerged from the cocoons towards the end of August, when I noticed for the first time that the saw-fly was not the common form *Lophyrus pini*, and I suspected *L. rufus*. This suspicion was confirmed on my sending specimens for identification to Dr MacDougall, who informed me that the species was believed to have only one generation in the year, and that the eggs laid by the flies which emerged in early autumn pass the winter as eggs. This has proved to be the case. Hatching began on the 15th of May 1907, and continued till the beginning of June. On the first signs of hatching I sent two men with hedge gloves to crush the young broods. This was fairly easily done, as at this stage the insects do not exceed an eighth part of an inch in length, and are in compact broods on individual needles of the plants instead of being scattered over the shoot as is the case when they grow larger and more voracious.

The plantation has been gone over four times this year, and while I should not care to maintain that every larva has been killed, still, I think few have escaped. Last year £2, 14s. 9d. was spent in combating the attack. This year the figure has run up to £9. The damage was severe last year, but is comparatively trifling this year, not because there were fewer insects but because they were dealt with as they hatched out and never reached their most voracious stage.

It is to be noticed that *L. rufus* is at all stages rather smaller than *L. pini*. When first hatched out the larvæ of the former are about one-eighth inch long, with glossy black heads and dull grey-black bodies. When full-fed they are about three quarters of an inch long, with glossy jet black heads and dull grey-green bodies. There is a lighter longitudinal stripe down the back, and a broken black line above the abdominal and thoracic feet and legs. The body narrows from the thorax to the rear extremity, which is grey-black in colour. The thoracic feet have light and black bands alternately. There are 16 prolegs and 6 thoracic legs. In common with other sawfly larvæ, *L. rufus* when disturbed takes the characteristic S shape.

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II. Forest Nurseries and Gardens—Some Suggestions.

By Lieut.-Colonel F. BAILEY.

I.

In a previous issue of the *Transactions* I drew attention to the recommendations made by the Forestry Committee (1902) in regard to State Demonstration Forests and Example Plots or Forest Gardens. The Committee's suggestion was that an area of from 100 to 200 acres, to be used as a garden, should be provided *at each educational centre.* The purpose of the garden is thus stated in pars. 15, 20, and 36 of the Report:[1]—

"Even where access may be had to private woods, it is exceedingly desirable that collegiate instruction in forestry should be illustrated by means of example plots. These are a considerable feature of the teaching in the University of Giessen and elsewhere on the Continent, and they have been reproduced on a small scale at Coopers Hill and on the Northumberland Demonstration Farm."

. . . . . .

"We have stated that we consider it necessary to have 'Example Plots' in connection with the universities and other centres of instruction, as well as two large State Demonstration Areas; and it may be well to explain here why both are required. The Example Plots should embrace a comparatively small area, and comprise an arboretum or collection of specimen trees, and also an area devoted to the experimental planting and growth of trees in masses *up to a certain age.*[2] Such an area cannot, from the very nature of the objects aimed at, be expected to *yield a profit.*[2] . . . Forest students from the universities and others would spend a week or two at a time, or longer, in the Demonstration Forest; but they and the lecturer also require an area *close at hand,*[2] to which resort can be more frequently made."

Referring to the above extracts, I observed that their perusal left no doubt that the Committee desired each teaching centre to have its own "Example Plots" or Forest Gardens (as I prefer to call them), and that they intended these gardens to be "close at hand," so that frequent visits to them might be made. It is, indeed, essential that lectures should be "illustrated" by means of such gardens, because in regard to most of the subjects

[1] "Example Plots or Forest Gardens," Vol. XIX. p. 317.

[2] The italics are mine.—F. B.

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dealt with by the lecturer, clear and abiding ideas cannot be imparted by means of class-room lectures alone, nor otherwise than by frequent visits with the lecturer (or without him in any spare time the students may find) to some place where practical illustrations may be seen. Students must make themselves thoroughly familiar with the appearance at different seasons of the year, and with the rate and manner of development in crown and root of the various species up to the age at which they are to be found in the garden. They must also be familiar with the behaviour during youth of the various species when grown in mixture, and with their effect on each other. They should also do nursery work, planting and direct sowing, with their own hands. The students have very little time at their disposal for excursions, and it is evident that unless the Forest Garden be "close at hand," effectual practical instruction in elementary forest work cannot be given. If a Demonstration Forest were so situated, there would evidently be no need to provide a Forest Garden; for in the former would be seen all that it could be desired to show in the latter, and a great deal more in addition. But there is no hope that a large forest can be established in the immediate vicinity of any of the present teaching centres, and hence arises the necessity for each such centre possessing its own Forest Garden, in which the evolution of a forest crop up to a certain stage in its development can be practically illustrated. If the Forest Garden is not near enough to the lecture-room to serve this purpose, it would be sheer waste of money to establish it. I would rather take a small area suitably located than a larger one situated at a distance which would render it very much less useful to me.

It is beyond doubt that the Committee intended the garden to be an adjunct to the lecture-room, provided to enable the lecturer to illustrate his teaching; and it cannot serve this purpose unless it be placed under the control of the teacher, who should be given a free hand in all details of its management.

It is of course necessary to provide a nursery, and a part of the garden must be devoted to this use; but on account of the difficulty of obtaining so large an area as 100 to 200 acres near to the lecture-room, it may be necessary to rest content with a nursery so situated, leaving the garden to be formed on the nearest suitable site that may be available. The nursery and the garden will therefore be considered separately.

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II. The Forest Nursery.

In the second volume of his *Manual of Sylviculture*, Dr Schlich deals with 32 species of trees, of which 21 are "hardwoods" and the remaining 11 are conifers. To these may be added some 8 or 10 exotic conifers, which it is desired to study with a view to their use as forest-trees in this country; so that provision should be made for the raising in the nursery of at least 40 species, of which one-half may be conifers.

If one-twentieth of an acre be allotted to each species, each may occupy a plot of ground 15 yards square, with 17 square yards over for seed-beds and minor paths.

In the case of conifers, seed-beds showing both one-year-old and two-year-old seedlings are required; and the nursery lines must show transplants that have stood in them (whether shifted or not) for one year and for two years. The plot of 15 by 15 yards may therefore be subdivided into two equal portions, each measuring 15 by 7½ yards.

If the nursery lines are drawn at, on an average, 9-inch intervals, and if the plants are set at 3 inches apart within them, there will be, in each subdivision, 30 such lines, each 45 feet long, and containing 180 plants. The total number of plants will therefore be 5400. To keep the nursery going, this number of seedlings will be required annually, and they can be raised on a pair of seed-beds each covering 4 or 5 square yards. The whole plot will carry some 10,000 or 11,000 plants.

In the case of "hardwoods," the nursery lines may be on an average 18 inches apart, and the plants may be placed at 4-inch intervals within the lines. On the plot of 15 by 15 yards there will thus be 30 such lines, each 45 feet in length and carrying 135 plants, the total number of plants being about 4000.

In addition to the two acres required to raise the 40 species above referred to, provision must be made for other species, which it may, later on, be desired to show in the nursery, and the area must be increased by one-third to allow of periodic green-crop manuring. Space must also be available for the carrying out of such special experiments as it may be necessary to undertake. On a part of the ground young trees will be allowed to grow beyond nursery age, and space will be required for buildings and roads, so that a total area of at least 4 acres is necessary.

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In addition to its use for the ordinary work of raising young trees, the nursery will form an important section of the laboratory of the teacher of forestry in connection with the following, among other subjects of special study, viz.:—The germinative capacity of seeds of various species; intervals of time elapsing between sowing and germination; methods of treatment to hasten germination; methods of protecting sown seeds against the depredations of birds, mice, etc.; methods of storing seed; methods of husking and cleaning seed; weighment of seeds, with comparison of the results obtained by sowing relatively heavy and relatively light seed of various species; depth of soil-covering best suited to each species; root and stem development of the several species at various ages; preservation of root fungi promoting growth; green crop and chemical or other manure best suited for nursery work. Observations on the above and other subjects will no doubt be regularly made and recorded by the teacher of forestry, much of whose time will be thus occupied; and on this account, as well as to enable students to pay frequent visits to it, the nursery should be situated as near as possible to the class-room. It should be rectangular in shape. The soil should consist of light loam, and water must be obtainable on the ground. In conclusion, it may be added that all ordinary nursery work must be conducted on business lines, with a view to the production of the best possible plants at the smallest possible cost. Expenditure in connection with the subjects of special study above referred to would not form a fair charge against the nursery, as it would be incurred for instructional purposes, and it should be charged separately.

III. Forest Garden or Example Plots.

Unlike the Demonstration Forest, in which crops will be grown to full size, the Forest Garden will exhibit them up to a certain age only, and this for the obvious reason that on the smaller area there will be no room to show all stages in the growth of the numerous species that will appear there. Any attempt to treat the garden as a Demonstration Forest, by permitting a desire for direct profit to influence its management, would greatly impair its capacity to fulfil its legitimate purpose.

In common with the forest nursery, the garden is an adjunct of the lecture-room, and it should, as regards all details of

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management, be at the disposal of the lecturer, who cannot otherwise ensure that it will suitably illustrate his lectures. Again, as the courses of lectures at the various educational centres cannot be modified in accordance with the silvicultural conditions of the surrounding locality, it follows that neither can the management of the garden be so modified without serious impairment of its usefulness. Most of the species it will be desired to grow in any garden will probably grow fairly well up to a certain age on any ground that might be selected for the purpose; and the further study of all species alike must be carried on in the Demonstration Forest; for the success or failure of the various species, as full-grown forest crops, cannot be proved in the garden. If, however, owing to unsuitable environment, any selected species should fail to serve its purpose in the garden, its cultivation there would be dropped. The elevation of the ground selected for the garden should not much exceed 800 feet. The site should have a moderate slope, with good natural drainage, and should not be much exposed to cold or to strong winds. The soil, which should be sufficiently deep, should possess a fair degree of fertility, judged by the forester's standard; and the area should lie in a single compact block, with as wide a range of altitude as may be compatible with this condition.

Suppose an area of 200 acres to be available. A commencement might be made by stocking a compact block of 25 acres in 1-acre plots of the following species, viz.:—

Hardwoods.	*Conifers.*
English elm.	Silver fir.
Scotch elm.	Spruce.
Sweet chestnut.	Larch.
Pedunculate oak.	Austrian pine.
Sessile oak.	Weymouth pine.
Beech.	Scots pine.
Norway maple.	Corsican pine.
Sycamore.	Douglas fir (Oregon).
Ash.	Douglas fir (Colorado).
Common alder.	Hemlock spruce.
Hornbeam.	Sitka spruce.
Black poplar.	Japanese larch.
	Thuya sp.

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Some others might be added later, such as *Robinia*, willow (sp.), Cembran pine, Mountain pine, *Abies grandis*, *A. nobilis*, Siberian larch, and Lawson's cypress. After successive intervals of say eight or ten years, these crops might be repeated on half-acre plots, so as to illustrate the development of the various species at intervals up to the age of 30, 40, or even 50 years, as might hereafter be desired in the case of each. After reserving space for this purpose, and a small plot of say 3 or 4 acres as an arboretum to exhibit specimen trees of full age, the remainder of the ground would be available for experimental work, as, for example, for mixtures illustrating various combinations of species, arranged in differing proportions and in various ways; and also in connection with the other matters enumerated below. Ground not required immediately for the above purposes might in the meantime be devoted to agriculture; but if unsuited to that use, part of it might be stocked with a quick-growing species of tree, which would yield some revenue when the ground it occupies is otherwise required. On the plots thus established the following, among other matters, will be specially studied:—The botanical characteristics of the several species; their appearance at different seasons of the year; their characteristic development in height and shape; the pruning of hardwoods; treatment of attack by insects, fungi, or adverse atmospheric influences; direct sowing; method and density of planting, and size of seedlings or transplants to be employed; uses of various manures; measurement of individual trees and of growing stock, with yield under various conditions.

It will probably be possible to underplant some of the light-crowned species, such as larch, before they have reached the age limit of the garden. If the ground selected carries growing woods, these can be made use of temporarily for instruction in the measurement of trees and crops, until the space they occupy is required for other purposes, when they will, in most cases, be removed. It need hardly be said that if a nursery be provided separately, it need not be duplicated within the garden area.

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12. The Afforestation Conference.

On the joint invitation of the Board of Agriculture and the Local Government Board, a Conference on the subject of Afforestation assembled in London on the 25th June 1907, under the presidency of the Right Hon. the Earl Carrington, President of the Board of Agriculture, who was supported by the Right Hon. John Burns, President of the Local Government Board. The Conference was called together in consequence of the receipt of the following resolution from the Association of Municipal Corporations:—

"That this Council expresses its opinion that the time has now arrived when the question of afforestation should be seriously considered by the Government, and that it should be referred to the Law Committee to take steps for urging upon the Government the necessity for initiating afforestation schemes." It was attended by a large number of persons interested in the subject of afforestation, and a verbatim report of the speeches and papers will be found in the official *Report* (No. 98), printed at His Majesty's Stationery Office, price 6d. This *Report* occupies 49 pages, and we here give a short summary of its contents, for the convenience of those among our readers who may be prevented by lack of time or opportunity from reading the original.

After a short speech by Lord Carrington, stating that the object of the Conference was to examine the proposals of the Association of Municipal Corporations, and to elicit opinion as to the course which should be adopted both by the Government and by local authorities to carry out the desired objects, Mr John Burns made a sympathetic speech on behalf of the Local Government Board, in the course of which he gave it as his opinion that afforestation had been too optimistically regarded as a means of giving immediate occupation to the unemployed, while at the same time he believed that ultimately, by the establishment and encouragement of rural industries, it might prove of great value in this respect. He further stated that, as an individual, he was greatly in favour of the establishment of a School of Forestry.

A sentence or two may be here quoted from the *Report*:— "I think," said Mr Burns, "the time has arrived either when the State or the municipality, or both combined, might give free

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expert advice to municipalities and private owners for planting their catchment-areas and their woodlands or potential woodland possessions. . . . I should be only too pleased to consider possible loans for afforestation, and would favourably consider the practicability of loans that were applied for for the afforestation of land" (*Report*, p. 8).

These introductory speeches were followed by a number of others. For our purpose it may be well to consider their contents under two heads:—*First*, those which dealt with definite facts, due to observation or experiment, or both; and *Second*, those whose object was to bring forward suggestions, recommendations, or criticisms. Not a few speeches fall under both headings, but it is convenient to summarise first the facts brought out during the Conference, before considering the deductions made from these or other facts by the speakers.

The actual business was begun with a paper by Dr Schlich, F.R.S., who, by special invitation of Lord Carrington, spoke on "Forestry as an Investment." Dr Schlich pointed out that complete data, in regard to British woods, are not easy to get, because, for the most part, they have not hitherto been managed purely as business concerns; but he gave four examples of woods which have yielded a fair margin of profit, and concluded by saying that in his opinion the afforestation of surplus land in this country will pay, provided the lands are not situated above a certain height, which varies with latitude; that the right species are selected in each case, according to the condition of the locality; that the planting is done efficiently; above all, that the woods are properly tended, the chief art of the forester consisting in thinning his woods at the proper time and in the right way; and finally, that the work is done economically.

Mr S. Margerison of Leeds followed by reading a paper dealing with the "Comparative Qualities of British and Foreign Timber." He stated that in his opinion the natural conditions in Britain are such as to permit the growing of timber, of the species mostly required, of equal quality with that of other countries in similar latitudes, provided the culture is done on sound lines. As regards, first, the broad-leaved trees, he said that it is no empty boast to say that there is no oak superior to British oak, and that much of the foreign oak is vastly inferior to it. Best English ash has no rival which can compete with it in price and

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quality combined, while British beech, sycamore, alder, and birch are equal to and often better than the imported material. As to conifers, much inquiry and observation have convinced Mr Margerison that there is no reason why we should not grow them of equal quality and in as large crops as those of Continental production, provided the system of cultivation is similar. English spruce, Scots pine, and even larch, where the disease is not too prevalent, form profitable crops, and the product is as good or better than that of Continental origin. These are the principal trees which, in the author's opinion, it is at present worth growing, and where the conditions are favourable, their cultivation will yield a fair profit. Where forestry does not pay in this country, this is often owing to injudicious planting and faulty methods of management—"a bold, continuous, well-planned policy *will* pay." Mr Margerison concluded with some observation on forestry and the unemployed, to which we shall return later.

Another paper dealing primarily with facts was that delivered by Mr Joseph Parry of Liverpool, who gave an account of the work done by the Liverpool Corporation at Vyrnwy and Rivington. The Corporation commenced systematic planting operations in the Vyrnwy area in 1896, but it was not until 1903 that much progress was made. Between the years 1897 and 1907 they have planted 1,034,056 trees, and the work is now being continued at the rate of 300,000 trees per annum. The total area selected for planting on the watershed is 1202 acres, and when planting is completed the total number of trees put out will be about 4,000,000. The trees here planted are chiefly larch, spruce, Douglas fir, silver fir, Corsican pine, alder, oak, and ash. The expenditure on planting has been at the rate of £6, 15s. 3d. per acre, but this includes the cost of clearance, which will not have to be incurred again; it also includes a large outlay for plants, which will in future be supplied from the Corporation nurseries at a much lower rate. As regards the Rivington area, operations were undertaken in 1904, when to begin with an area of 571½ acres was selected, which was afterwards increased to 1243 acres. In the period of three years which has since elapsed, 349 acres have been planted, and the total number of trees on the area is now 1,291,295. The species are chiefly beech, ash, oak, sycamore, spruce, alder,

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and some willows. A good deal of this expenditure is exceptional and will not be repeated. A recent plantation has been made at an average cost for planting, including the purchase of plants, of £2, 8s. 9d. per acre, and it is estimated that in future the cost of planting in the Rivington watershed will not exceed £3 per acre, this estimate including a certain proportion of bought plants. The Corporation are of opinion that ultimately the afforestation works will yield an asset of high value to the community.

Alderman Sir Bosden Leech gave a short account of what is being done by the Corporation of Manchester in the catchment-area of its waterworks. They have planted about 500 acres of land, and during the last six years have been planting at the rate of about 50 acres per annum. During the last two years 75 acres have been planted each year, 100,000 plants having been put out last year.

Mr Lees gave some account of the planting operations carried on by the Corporation in the Birmingham catchment-area. Work was commenced in this area in 1902, and 410 acres have been planted, at a total average cost per acre of £7, 6s. 6d., of which sum the actual planting cost £4, 2s. 8d. per acre, the remainder being accounted for by the expenses of clearing, fencing, etc.

The above summary may be regarded as containing the more essential facts brought to the notice of the Conference, and in considering the suggestions, criticisms, etc., put forward, it is important to note that the object of the Conference was to consider methods of forwarding afforestation by the Government or by local authorities. In this connection Mr E. J. Elwes, F.R.S., President of the English Arboricultural Society, pointed out that the possibility of profit in forestry depended greatly upon the price of the land, and that "municipalities always, and the Government generally, buy land a good deal too dear." Further, he emphasised the fact that for successful forestry a great deal of local knowledge is required, and that the commercial value of timber depends so much upon the proximity of a market, that forestry can never be anything but highly speculative—"the most distinct gambling in futures that can be imagined." The landowner's profit, which is not so large as has been supposed, is, Mr Elwes says, rather indirect, in increasing the amenity and thus augmenting the value of his land, than directly commercial.

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Mr Harmood-Banner, M.P., and Mr C. H. Scott Plummer, of the Royal Scottish Arboricultural Society, both gave it as their opinion that private owners are not likely to do *more* for afforestation in the future than in the past, but rather less. Again, a number of speeches and papers seem to make it clear that large corporations, holding extensive tracts of land for public purposes, notably in connection with water-supplies, but also in connection with methods of sewage disposal, are almost necessarily committed to afforestation work of some kind.

We have given above some facts in regard to the work actually being done by certain corporations, but some of the papers are important in their clear statement of the reasons which make it probable that the necessity for afforestation work will be increasingly recognised by the larger corporations. For instance, Mr Margerison pointed out that an increasing body of expert opinion is in favour of reducing or diminishing agricultural operations on water-catchment areas. This means a considerable loss of revenue to the community unless some other source of profit can be found. That afforestation is likely to be found desirable is further indicated by the fact that such areas are not infrequently, in the case of large towns, within reach of an industrial community where the demand for timber is likely to be great. Again, the actual effect of forest on the collection, conservation, and purity of the water-supply is of great importance. It may be said, in brief, that "forests cause an immense reduction in evaporation from the ground and reservoirs; they promote percolation and filtration through the ground to the shales and consequent water-springs; they reduce the surface-flow of the precipitated rain, and, by promotion of ground percolation towards the shales, promote an increase of spring-water, and at the same time conserve the flood-water and help to let it down more gradually to the reservoirs for times of scarcity; they prevent or reduce enormous quantities of silt being carried into the reservoirs; and lastly, the balance of evidence is in favour of the theory that they promote precipitation of moisture" (*Report*,[1] p. 18).

The subject of municipal action was discussed by Alderman Burgess, of Liverpool, to a similar effect. On the other hand, Mr G. Trevelyan Lee, the Town-Clerk of Derby, pointed

[1] In the *Report* a line has been omitted, but we are authorised to state that the sentence should read as above.—HON. ED.

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out that the smaller municipalities, and those which do not possess tracts of land which cannot be used for agricultural purposes, are in quite a different position, and that such municipalities could not undertake any form of afforestation whatever under existing conditions, that is, without some direct assistance from the State. The problem then, as it presents itself to municipalities, may be stated thus:—What kind of Government aid would enable those municipalities which have already begun afforestation on a small scale to extend their operations, and would at the same time afford encouragement to the smaller bodies to make a beginning. Before outlining the chief suggestions put forward by representatives of local authorities, it may be well to note that the problem is considerably complicated by the fact that it is closely connected with the unemployed question—first, because afforestation has been strongly supported by some as one, among other, means of providing work for the "unemployed"; and second, because some of the larger municipalities, notably Leeds, have been making experiments in this direction. The *Report* indicates a consensus of opinion that afforestation cannot be regarded as an immediate and radical cure for unemployment, and that the use of the unemployed for the purpose of planting, or even of clearing the land, is fraught with many difficulties. The following remarks by Councillor Ogden, Chairman of the Leeds Waterworks Committee, appear to represent a considerable body of opinion:—"If afforestation is complicated by being associated with the necessity for finding employment for the unemployed, the prospects of a profit absolutely disappear" (*Report*, p. 42).

A speech by Mr A. C. Forbes, Forestry Expert, Irish Department, states concisely the chief objections which have been found in practice to any considerable use of the unemployed in an afforestation scheme, and may be summarised as follows:—The first difficulty is in connection with the acquisition of suitable land. Near large industrial centres, such land is not usually obtainable except at a heavy outlay, and if the land be at some distance from the town, the difficulties connected with transport are very great. If the men have to be accommodated on the spot, a very heavy expenditure for huts or sheds is incurred, in view of the short period during which these huts are likely to be utilised. Again, a large number of the unemployed are found to be casual labourers,

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unfitted alike by habit and physique for the laborious toil which forestry entails. Further, the need for temporary employment usually arises suddenly, and cannot be anticipated many weeks in advance, while forestry work is not of a kind which can be taken up and dropped at a moment's notice, but entails anticipation by months.

The absence of the necessary experience in the unemployed, and the fact that relief work is required at a period of the year when work in the open is unpleasant, were points also emphasised by Mr Elwes, who opposed the utilisation of the unemployed for forestry purposes, as did various other speakers. On the other hand, as was pointed out by Mr Thomas Shaw of Sheffield, *all large corporations are faced with the fact that relief work has to be found not only for the unemployed, but also at certain seasons for members of the corporation staff, some of whom are thoroughly accustomed to open-air work, but for whom it is difficult to find sufficient employment during the winter season. As these men have to be employed, they are frequently put to stone-breaking or other useless work, which could be done much cheaper by other methods. Even, therefore, if tree-planting is not directly profitable, it might be found that the loss in it was much less than in some other methods of relief, while there is always a possibility of ultimate profit. For this reason, if for no other, it would be worth while for the Government to encourage local authorities to undertake afforestation work.*

Another point was emphasised by several speakers—granted that afforestation cannot be looked upon as an immediate and commercially profitable cure for unemployment, it is important not to forget its potential value in reducing the causes which lead to unemployment. It may be granted that to turn a large body of unselected men—who, for the most part, do not desire anything but temporary employment—out on a hillside to engage in forestry operations is to court disaster; but, on the other hand, as Mr A. C. Forbes pointed out, many of the difficulties can be avoided by "associating afforestation, not with the temporary provision of employment, but by attaching it to a carefully thought-out scheme of a more permanent and progressive character" (*Report*, p. 48). Mr Forbes brought forward the suggestion previously made by Dr Schlich in a lecture delivered at the Carpenters' Hall, that an effort should be made to build up a permanent staff on afforestation areas with

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the casuals of large towns in such a way that the men might cease to be casuals, and would become permanent rural labourers. Mr Margerison and others emphasised a similar point of view—that afforestation work in connection with unemployment must be regarded rather as educative than as immediately remedial, and that the men employed should be carefully selected as suitable for the purpose. Others, such as Alderman Burgess, emphasised also the possibility of minor rural industries springing up in the vicinity of the planted areas, and thus helping to retain the population on the land.

It may thus be said that the result of the Conference was to show that certain local authorities are already committed to forestry operations on a moderate scale, and that, in the opinion of many, it is desirable that this scale should be enlarged, on the one hand because of the possibility of ultimately producing woods which will form valuable commercial assets, and secondly, because of the need of attaching more of the population to the land, and therefore diminishing the number of casual unemployed who constitute so serious a charge on the authorities of the larger towns. We may now sum up the suggestions made as to the best methods of encouraging the work.

Taking the more general points first, it may be noted that, as stated above, Mr John Burns favoured the establishment of a School of Forestry, and the giving of expert advice by the Government. Several speakers spoke of the need of some system whereby expert advice could be given to municipalities by a Government department, if possible free of charge. This was especially emphasised by Mr Parry, who spoke of the great importance of expert guidance; by Alderman Sir Bosden Leech, who thought that schools of forestry or experimental farms should be established with the object of giving advice, especially in regard to plant diseases; by Councillor Ogden, who thought that careful statistics, based on British forestry, should be collected by the Board of Agriculture for the guidance of municipalities; and by Mr Richard Johnson, who thought that the Department of Woods and Forests should give advice on the subject to local authorities.

Again, Sir J. Rolleston recommended that the effort to promote afforestation should be national rather than local, and urged that the Board of Agriculture should give a grant for the purpose of commencing operations; and Mr Trevelyan Lee

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gave it as his opinion that if afforestation was left entirely to the municipalities, "practically nothing will be done except in the case of large municipalities who at present own land which is not profitable" (*Report*, p. 44). On the other hand, the Commissioner of Woods and Forests, Mr E. Stafford Howard, C.B., thought that municipalities should be encouraged to take action in the matter. The remaining speakers were in many cases representatives of municipalities already engaged in afforestation schemes, and we have to consider the detailed suggestions which they put forward as to the amount of Government assistance which they desired.

Mr Margerison suggested that the Local Government Board should assist by an extension of the Leeds experiment, "by making annual grants on labour account to meet the expenditure of municipalities on the other costs of afforestation" (p. 19). Similar suggestions, that the Government should make grants. or that the special outlay in connection with the engagement of the unemployed in afforestation work should be defrayed by Government, were made by several speakers. Others, notably Mr Lees of Birmingham, spoke more in detail as to the difficulties which municipalities experience in regard to the question of the account to which the sums expended on afforestation should be charged. Mr Lees said: "We have had calculations given as to the amount that may be anticipated after so many years—thirty or forty years,—but clearly no prudent accountant would venture to charge the interest and the sinking fund on the sums invested to any account but revenue account; and so, although the yield may come eventually, the effect upon our revenues for the time being, and during the period of growth, is an absolutely dead charge, and it is those who will come after us, if the crops turn out to be as successful as has been prognosticated, who will get not only the net profit, but the whole of the gross yield, because everything that has been spent in the meanwhile in the way of interest and maintenance charges must, under any prudent system of book-keeping, be debited straight away to revenue, and paid for out and out. One dare not suggest—it would be altogether too imprudent—that there should be any method of capitalising these charges, but in the absence of such method it seems to me inevitable that the prospect of providing for the future is entirely discounted by the necessity of heavy charges in the present. If afforestation is to be carried out to any large extent, that is an aspect of the

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question that must be faced. While we are dealing with comparatively small areas, such as those we have been speaking about, the afforestation is comparatively a small one, and does not hurt any of us, but if carried out to a large extent, the question will be a most important one" (*Report*, pp. 41, 42).

Dealing with the same question, Councillor Ogden thought that, for the purpose of loans, afforestation should be deemed to be a sewage or waterwork's question, and should be subject to the same rules. Mr Richard Johnson thought that the Local Government Board should not only give grants, but should also "lend money for a long term, and practically without interest, until the scheme became profit-bearing." This would get over Mr Lees' difficulty. Mr Trevelyan Lee gave it as his opinion that since in other departments, such as education, it was clearly understood that where the local bodies performed a function regarded as national, they should be assisted by the Government, so in respect of afforestation, as the profit would be national rather than local, the Government should bear the expense.

Another point, emphasised especially by Mr Harmood-Banner, dealt with the question of rates. This speaker, along with some others, brought to notice the check to municipal effort given by the increased rates which are put on as soon as the local authority begins to develop land which has hitherto been waste. Mr Harmood-Banner proposed that municipalities "should be relieved from the payment of rates as regards those particular districts to which afforestation had been applied, as well as regards the sums which had been set aside for the Distress Committee" (p. 23).

Other points which were emphasised by certain speakers concerned difficulties which municipalities have in acquiring powers to enclose common land for afforestation purposes, and as regards ground game, but these are for the most part minor points, less important as regards the general question of municipal and national work than those named above.

Forestry and the Unemployed.

In connection with the above, we may note that on 31st August the *Times* gave some account of the afforestation work carried on in Leeds by the unemployed during the past year. According to this account, which is based upon the report of the

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Leeds Distress Committee, the following work was done in connection with the planting of Washburn Valley. The work lasted from 19th November 1906 to 8th June 1907, and 199 men were employed, the period of employment ranging from one day to sixteen weeks. The total number of trees planted was 953,500, fresh unskilled men planting from 200 to 300 trees per day, experienced men an average of 816 trees in one day. On Beecroft's Moor 230,500 trees were planted, 3250 yards of wire netting fixed, and 400 yards of drains opened; on Bray's allotment 291,000 trees were planted, 3000 yards of wire netting fixed, and 400 yards of drains opened; on Swinsty Moor 39,000 trees were planted, and at Gill Beck Nursery 393,000 seedlings were planted, 200 loads of stone dug, and 1700 square yards of road formed. Three hundred acres have been planted, leaving 550 acres to be dealt with.

In a letter to the *Times*, commenting on this report, published on 12th September 1907, Dr Schlich says:—

"As I was the first to propose the afforestation of surplus lands as an auxiliary in dealing with the case of the unemployed, it is a source of great satisfaction to me that the Corporation of Leeds has been so successful in its afforestation work by means of the unemployed. My proposals have on several occasions been called unpractical, because first attempts, made more or less in the direction indicated by me, were not successful. But, then, Rome was not built in a day. The system of employing these men requires a little development; and I feel sure that a few years hence the initial difficulties will have been overcome, if an earnest attempt is made to do so. It is essential that there should be a small permanent staff of men on the area, the members of which will act as foremen when the unemployed come during the winter time, while they will find ample work during summer on nursery work.

"I sincerely trust that the Corporation of Leeds will continue the experiment, and thus prove that the unemployed can be successfully utilised on a work which is likely to lead to tangible results, whereas this is not the case of so many other kinds of work done by them.

"The price of timber has slowly but steadily risen since 1895, owing to the increasing difficulty of meeting demands; and there is little doubt, if any, that any surplus areas now planted will give quite satisfactory financial results, if the work is done systematically and in the right way."

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13. A Forest Tramway.

(With Plate.)

By FRED. MOON.

The wood roads, serving the principal wooded area on the Roxburghe Estates, being at all times bad and occasionally impassable, the question of how to improve them became imperative, in order that the annual fellings might be conveyed to the saw-mill at a reasonable cost.

It was first decided to metal the existing rides, but as stones had to be hauled a distance of five miles, the cost for such a large undertaking promised to become prohibitive. The writer then suggested a forest tramway, and, after full consideration, this was sanctioned.

A brief comparison of the two systems of metalled road and tramway is as follows:—A substantial metalled road for heavy traffic is expensive to make and maintain, especially when good stone cannot be got on the spot. The road is a permanent structure which can only command a limited area, and in the case of a wood road is only used periodically, and deteriorates during the periods of disuse. A light railway is less expensive to lay and maintain, requires less power to haul over, and, above all, is portable, and commands a circular area with its own length as radius.

SPECIFICATION AND COST OF MATERIAL AND LABOUR.

1300 yds. light railway material, 24 ins. gauge, consisting of:—(1) 520 flat bottom steel rails, 14 lbs. per yd., in 15 ft. sections, complete with fish plates, bolts, and nuts; (2) 1300 single corrugated steel sleepers, 30 ins. long, $3\frac{1}{2}$ ins. wide $\times \frac{1}{8}$ in. thick, complete with their necessary bolts and nuts for laying 3 ft. apart, with rivetted clip for 14 lbs. flat bottom steel rails, with clutch bolts $4\frac{3}{4}$ ins. $\times \frac{1}{2}$ in., and with nuts and washers. The above at per yard of line, 2s. 9d.,	£178	15	0
Two sets points, £3,	6	0	0
Four sets each of two bogies with double screw brakes, swivel bolsters, chains, jacks, and all the necessary fittings complete,	54	16	0
1300 creosoted Scots intermediate sleepers, 3 ft. $\times$ 5 ins. $\times$ $1\frac{1}{2}$ ins.,	11	14	0
Labour on laying track and tarring rails,	35	0	0
	£286	5	0

or about 4s. 5d. per yard.

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The intermediate wood sleepers sawn out of tops were, on account of the soft nature of the ground, used to supplement the steel sleepers, with a view of easing the strain on the rails.

The track was laid in the dead of winter, during the shortest days, and with snow and frost to contend with. Had it been possible to do this in summer, the labour bill would have been reduced by one-third, as the men are paid at the same rate in summer as in winter. The convenience, however, of doing the work at that season outweighed all other considerations, and the advance in the price of iron subsequent to purchase probably makes the difference more apparent than real.

The bogies are hauled from the saw-mill to the felling area by horse. The cuts, mostly 10 ft. and 18 ft., are hauled to the railway side, the heavier ones with their butts on a sledge and the lighter ones in the usual way. They are then loaded on to the bogies by skids, secured by chains and jacks, and returned to the saw-mill, one-third of the way by horse haulage and the remaining two-thirds down a declivity under control of the brakes and a rope.

The two sets of points are in use, one at the felling area to form a spur, and the other at the foot of the declivity and near the saw-mill, as runaway points, to automatically switch the loaded bogies, in case of accident, into a sawdust heap.

On the average, it costs 3s. per 100 quarter-girth cubic feet to bring timber from the felling area to the saw-mill by tramway. To cart the same quantity costs 6s. 3d.

One horse alone cannot keep the mill supplied by cart haulage, but by tramway one horse can easily do this in three days of each week. This leaves the horse available for other jobs on the remaining three days, which, taken by itself, is a great economy and convenience.

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A FOREST TRAMWAY—HAULING.

A FOREST TRAMWAY—APPLYING THE BRAKE.

[*To face page 72.*

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14. Continental Notes—France.

By A. G. HOBART-HAMPDEN.

For those who desire to know how Forestry is progressing in France, a perusal of the *Revue des Eaux et Forêts* is to be recommended. There is a constantly increasing number of forest societies in France, like the Society of "Franche Comté et Belfort" and the "Touring Club," each no doubt with their own Magazine, or at least Transactions, but the *Revue* is the service magazine *par excellence* of the French Forest Department, and its contributors are the most likely to be "at the front of the march of ideas," in the expressive French phrase, besides, probably, being more likely to have access to the official forest publications than the private forest owners and others who chiefly make up the other societies. In Germany, we believe, every national schoolboy learns something about forests, and now the French Minister of Public Instruction appears to be taking up the subject. It is a most encouraging sign that the French generally (apart from the State, which is, of course, a large forest proprietor) should be thus awaking to the importance of Forestry in France, as we are doing at home. There is plenty of scope, for M. Paul Descombes states that France has over $15\frac{1}{3}$ million acres of uncultivated land, on which, as a rule, forestry would pay better than anything else. Like us, the French encounter difficulties, but often of a somewhat different kind. One of their aims is to get communes to afforest their waste lands, and there they meet with the apathy of the peasant population and also the active hostility of the grazing interest, whereas we are mostly concerned with private property; and whatever the obstacles to the afforestation of private property, at least the owner is not, as a rule, hampered with the necessity of providing for the rights of other persons. Not but that it would, of course, be eminently satisfactory if the English Government were to become, as in other countries, a large forest owner. In the case of the present Crown forests, no doubt there often is, as in France and India and elsewhere, the irritating drawback of having to deal with rightholders, but in any additions that were made to the Government forests there would be as perfect freedom of action as in the case of private owners. All Continental nations, and some of our dependencies, make a good thing of their forests,—India

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is beginning to look to its forests to in some sort make up for the loss of its salt and opium revenues. We, on the other hand, pay £30,000,000 (which to-morrow will be forty, and the day after fifty, millions) to outsiders—in many cases to potential enemies, who will use our money to build ironclads wherewith to threaten us. Not only do we pay all this for timber or timber products, but in doing so we leave in foreign countries the money spent in forest work and many forest industries, instead of keeping it within our own shores, and, incidentally, establishing colonies of wood-working people out in the country. It is said, "Yes, but the Governments who make their forests pay have found their forests ready-established and already in bearing; and where, we should like to know, are we to find the money to buy up land and grow our forests?" Well, there must be a beginning some time, and at least the Government could let itself off taxes. The shooting rents, too, would be a direct source of revenue. If the unemployed were put on the work, with a patient, but rigorous, thinning out of the unemployables, the labour would be found, for a certain proportion of this class is no doubt deserving. This, we know, is an aspect of the matter which appeals to Government, quite apart from any question of finance. If *only* they would put a tax on foreign wood, and with the proceeds form a fund for buying up waste lands and planting and working them, the money difficulty would disappear; but this is politics, and I suppose we must not enter on that here.

There is a good deal that readers could skip in the *Revue des Eaux et Forêts*. As we are only concerned with the forest part, we could leave out the articles on fisheries, although these are not without importance. All the part directly concerned with the *personnel* of the French Forest Department will only interest those who have friends in that keen and enthusiastic service. There is much about forest law cases, which is perhaps rather boring,—moreover, we have no special forest law. Once indeed we had one, and of the severest, but it seems to have become merged in the common law. Were a really large Government forest domain to be formed a Forest Code might become a desideratum, and it might advantageously contain a section (as in the Indian Forest Code) allowing private owners to place their woodlands under its provisions. Finally, a glance at the Budget discussions, reported in the *Revue*, will generally suffice.

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In this connection it is satisfactory to see that the Chamber of Deputies is alive to the great necessity of afforesting the catchment areas of the great rivers, and the late tremendous floods will, we think, do much to force this matter still further to the front. The afforestation of mountains was, unless I am mistaken, begun in 1856, and several laws have been passed about it. British foresters desiring to see a really most interesting and magnificent work could scarcely do better than to visit some of the "perimètres de reboisement" in the French Alps, and elsewhere in France. We do not, indeed, suffer much here from erosion on hill-sides or from the silting up of rivers (as in the case of the Loire, or the Volga in Russia), but floods are not unknown to us, and afforestation generally — more especially the rewooding of hills — will always be of direct interest to us. I suppose if the State were to launch out into a real forest policy it would be principally in the hills of Scotland and Wales that the forests would be formed. Incidentally, I should like to mention that the French have an excellent plan of taking photographs, repeated at intervals of years, from fixed bench-marks, thus clearly showing the progress that has been made. This can be done, of course, not only with afforested hill-sides, but with forest operations generally, as, for example, at the period when an area has been just felled for, say, a seed-felling, and again five, ten, fifteen, etc., years after. The writer is himself doing this in Buckinghamshire, and looks forward to interesting results. The great difficulty is to get clear, sharp-cut pictures of forest growth; pretty pictures are easy enough, but that is not what one wants.

One sees from the *Revue* that the stripping of oak bark has become as unremunerative in France as it has with us. M.M. Truchot and Mélard have articles on this subject. What has killed the industry in France is chiefly the importation of Spanish chestnut and Quebracho wood for working up into extract. One wonders, speaking without expert knowledge, why, if direct tanning from the bark is unsuitable, it should not do to make extract from oak bark. One would have thought that when there is a considerable fall of oak it would pay to send the bark to the extract factories. Surely the same machinery would do for dealing with the bark as with the imported materials. Of course rail charges in Britain are unusually high, and bark is bulky. In point of fact, where

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there is plenty of room for storage and labour is cheap, tanners appear to prefer bark (of a good quality) to extract. At any rate that was the impression made on my mind when, a few years ago, I was on special duty in this connection at Cawnpore in India. Cawnpore is a large tanning centre, with several big tanneries, where some 60,000 tons of bark (nearly the whole being Babul bark, *Acacia arabica*) are annually used, and the country for a hundred miles along the railways is ransacked for this bark, for which about 1s. 4d. to 1s. 6d. a maund (82 lbs.) is paid. M. Mélard thinks that the present depreciation of oak bark may not last; the chestnut forests are probably being destroyed, and as for Quebracho, that species is a native of the Argentine, where there does not appear to be forest protection, without which the largest forest area will in time be destroyed, and that far quicker than is generally realised. Moreover, Quebracho wood is suitable for sleepers, and the great development of the Argentine will connote a great extension of railways. Also the influx of immigrants will go far towards the destruction of the forests. There are, however, some slight compensations to be had for the fall in the sale of the oak bark. The tendency to grow oak as coppice will decrease, and it is a sin not to grow such a timber-tree as oak to large dimensions, and with long boles fit for beams, in high forest. Also the necessity for felling the tree only when the sap is rising disappears.

M.M. Gallois and Buffault write on the difficulties of fire conservancy in the Maures et l'Estorel, in the south of France, where the fires are bad, the same difficulties applying to the pine forests of Gascony. They speak chiefly of the inertness of private proprietors in protecting their woods, which are mostly either cork-oak, or pine. The fact is the proprietors fear the expense of making fire-lines, and, when it is a case of completely clearing the lines of all trees, the direct loss. There is a law of 1893 which forbids fires being lit within 200 metres of the woods during the summer; permits a proprietor to make a border fire-line, cleared of all brushwood and all resinous trees, and then to force his neighbour to do the same; obliges all railways which traverse a wood to keep up similar cleared lines; and grants a certain subvention for constructing roads across the woods. In Britain, most fortunately, we are not greatly troubled with fire, but danger sometimes occurs from burning

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heather on the borders of a wood, and also from railway engine sparks. In the former case, a relatively narrow line along the edge of the heath should generally suffice for protection, except, perhaps, in the case of species like Scots pine. The upkeep of a broad cleared line in such a case would be expensive, and it would probably be wise to thin the pine and underplant the strip with Spanish chestnut, or to completely substitute an edging of broad-leaved trees for the pine. M. Gallois is against the complete clearance of all resinous trees from lines bordering pure resinous woods. To say nothing of the loss of the land thus put out of forest cultivation, the upkeep of such a line—always liable to become again covered with inflammable brushwood—is very onerous. He quotes the method adopted in the Prussian State Forests where railways traverse pine forests, and as we believe a Bill to deal with this matter is shortly to be brought before Parliament, perhaps it may be useful to consider it. The plan is to clear the trees for 17½ metres (about 58 feet) from the rails, while for 13 metres (say 40 feet) they thin and prune the lower branches of the pines and remove the undergrowth. In reality, though M. Gallois does not mention it, we believe there is in addition, at a little distance, a path or road parallel to the railway, and also transverse paths. Forstmeister Dr Kienitz,[1] proposes to clear of trees 12 to 15 metres only, cutting this belt across with alleys and ditches, and to thin and prune the trees, and clear the ground of brushwood, for another 18 metres. This, says M. Gallois, may suffice to catch the stray sparks of a railway engine, but the protection-belt should be 180 to 200 feet wide where a real automatic fire-line, to keep fire out, is wanted. One wishes it were possible in our Indian forests to rely on a row of spark-catching trees, and to save the loss of completely cleared lines, but, unfortunately, most trees there, including the pines, drop their leaves in the hot weather, thus completely covering with very inflammable material any lines burnt under the shade of trees. It may interest readers to know that they use telephones to connect the Forest Officers' houses with the Forest Guards' lodges in the south of France, and this, too, is done in the Forest of Dean.

M. De Gail writes of the progress of the insect invasion of the fir forests in the Vosges, near Gérardmer. The insects are

[1] See Vol. XVII. p. 198.—Hon. Ed.

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Bostrychus typographus, *B. chalcographus* and *B. curvidens*, and one of the *Pissodes*. The invasion, which has been something intense, appears happily to be passing away. The damage of 1904 was the worst, but the number of trees which had to be felled by reason of the attack of the first two of the above-mentioned insects is alone given, viz., 14,603. In 1905—for all the insects—15,701 trees were felled, while in 1906 only 4433 trees were attacked.

M. Hickel has a note to the effect that the approach of a good beech-mast year can be foreseen in the preceding autumn from the occurrence of swelled buds destined to bear fruit. These are some 8 millimetres in diameter, whereas the leaf-buds are only 3 or 4 millimetres thick; the former are generally shorter and always more obtuse, besides being thicker. Mathieu, the celebrated botanist, mentions this, and it is probably well known already to many. The following interesting quotation, from Mathieu, is also given by M. Hickel concerning these flower-buds: "Their abundance, their rarity, or their complete lack determines, nearly certainly, from the month of August the kind of mast of the following year. Thus the irregularity in the fructification of this species cannot be explained by the action of spring frosts alone. It is evident that the temperature of the year in which the buds are formed plays a preponderating part in the fructification." M. Hickel adds that, although a good acorn year cannot be prognosticated in a similar way, yet the fact that good beech and oak mast years have a way of coinciding renders it possible to tell to some extent when a good acorn year may be hoped for.

M. Émile Mer gives the results—in a number of tables and in a variety of ways—of the comparison of two nearly similarly situated plots of hornbeam coppice, the one thinned of its small shoots and the other unthinned. The thinning was made in 1891, but for certain reasons it was not possible to begin the measurements till ten years later. They were accordingly made in 1901 and 1906, and M. Mer shows that as a rule the coppice-shoots grew the more in diameter and height as there were fewer shoots on the stool; and that (in the case in point) the maximum volume and maximum value were attained with stools having four shoots. The figure would, of course, differ according to species and other factors, and the actual value of thinning an oak coppice would be less than thinning a coppice of a species which stands

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shade, since the weaker shoots would, in the former case, die off of themselves. In the case of the hornbeam the figures very definitely showed that the operation resulted, not only in producing better *individual* stool-shoots, but also that the volume, and, more still, the value, of the thinned *plot* was the greater.

M. Berthon complains that the rules in vogue for dealing with Selection-worked forests of spruce and silver fir are the same for the two species, and consist in seeking regeneration by more or less evenly thinning the wood throughout. Though this produces silver fir seedlings it does not result in spruce regeneration till several repetitions of the operation have sufficiently opened the cover, while in the meantime the stems remaining have suffered through not being retained in close crop, which is essential for spruce. Consequently he suggests that regeneration fellings for spruce should be made in gaps, the remainder of the crop being only lightly thinned where there is actual congestion. The soil should be wounded in these gaps. This sounds rational, and it seems to show that the French are beginning to see the beauties of the Group system, a system of which, at anyrate twenty-five years ago, one never heard in France. I think this system will more and more come to the front, for broad-leaved species as well as conifers. The one danger, for conifers in the hills, is wind, but probably if the gaps are sufficiently far apart, and not too pronounced, there need be no fear. Then one of the worst drawbacks of the Selection method, viz., the necessity for felling trees on the top of smaller ones, will disappear, and the irregularity of growth found in selection-grown timber will also disappear. With the Group method one is not tied down to a fixed and restricted coupe, but, working over a relatively larger area, one can seek out spots showing the first signs of young growth, and there remove the overhead crop. For species difficult to regenerate the Group method has much to recommend it. Broadly speaking, it enables one to *follow* the young growth (for there are nearly always some signs of it to be met with somewhere throughout the length and breadth of a wood), instead of making holes in the canopy to produce a problematical one.

The Algerian forests appear to be doing well. I believe that the French have had much trouble there in the past, and can well imagine that some of their methods have not been understood by the indigenous population: forest administration on

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correct lines is something altogether beyond the native mind. However, they seem to be doing well now. Whereas before 1898 the annual revenue was less than £40,000, it was well over £120,000 in 1904, and for 1905 the Budget estimate was nearly £177,000. But new avenues appear also to be opening out, as, for example, in the direction of resin-tapping. It is estimated that there are in Algeria at least 20,000,000 pine trees (*Pin d'Alep*) capable of producing annually £240,000 gross revenue. Incidentally the writer of the article mentions the *Pin de Masson*, in Tonquin, as a suitable tree for tapping. The world's demand for resin and turpentine has certainly greatly expanded of late, so this seems a promising direction for forest enterprise; but it should be remembered, as is perhaps not always sufficiently done, that although resin-tapping does not seem to adversely affect the quality of the wood, the timber, as used for planks or scantlings, is of course damaged at the points where the tapping has actually occurred. To tap a tree shortly before felling does not matter perhaps, for the wounds are only made in the sapwood, but tapping at intervals throughout the life of a tree must damage the timber permanently. It is interesting to note that 20,000 cubic metres of cedar (*C. atlantica* I suppose) is to be put on the market. It appears that during the five years, 1902 to 1906, the Algerian Forest Department has built 176 forest lodges (mostly for subordinates, no doubt), made 3910 kilometres of roads and 2000 kilometres of fire-lines, besides reforesting 5000 acres and stripping 600,000 cork-oaks. A good record!

Reference has been made previously to the increase of interest among landowners in connection with French Forestry matters, but an article by M. Pardé, quoting M. Ména, Conservator at Troyes, shows that this is not altogether a new thing, for since about 1860 a number of private persons, acting independently, and entirely without extraneous assistance, have been afforesting waste lands in the department of the Aube, in a very extensive manner. The Aube is watered by the Seine and several of its tributaries. Here and there—almost throughout the region—this work has been going on, and in particular in one chalk region, with very thin soil, some 30,000 to 40,000 acres have been planted, chiefly with Scots pine. Most unfortunately, these patriotic gentlemen appear not to have taken expert advice, and this pine has proved to be most unsuited to the

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locality, and, having very little vitality, it has succumbed to the *Lasiampa pini* and other troubles. At the same time, it has regenerated itself very vigorously. At some few places they have used the Austrian pine, with very good results, but inasmuch as there is a prejudice against this pine, it being supposed, quite wrongly as some think, to be little good and almost unsaleable, its extended use has not caught on. As a small plant it suffers much from the rabbit, but when it has reached 1½ foot high its thick lower branches save it from this pest. This is explained by the fact that it has been planted as much as 2 metres apart. With all the drawbacks to such wide planting, there is just this to be said, that as the layer of soil is so thin the roots have sought their nourishment laterally, and so have given vigour to the plants. It is most interesting to find, in quite a different article by M. Pardé, that the Austrian pine has elsewhere again come to the rescue. M. Pardé found it used at a place in Austria, where every sort of difficulty had to be encountered—a limestone rock with scarcely any soil, but many stones, a short rainfall, but heavy snow, bad frosts, and especially late ones, and finally, the "Bora," a violent N.E. wind, which dries the surface. Yet the pine was growing well, and at 26 to 28 years had begun to seed well. Normally this species only seeds well after 30 years, and earlier seeding is not perhaps a good sign. As to the perishing Scots pines in the Aube, they, too, have been indirectly valuable, for the population uses them as firewood. Had this source of supply not been available the peasants would have fallen back on cowdung cakes, after the manner of the Indian *ryot*.

M. Schlumberger enters once more on the old, old quarrel as to the respective merits of the Selection Method and that known as Shelterwood Compartment, or Uniform, or Successive fellings. In the course of this article he declares his adherence to possibility by area, instead of possibility by volume, in agreement with so many others nowadays. It would, however, be too lengthy a business to enter here on a consideration of these vexed questions.

M. Huffel calls attention to an ingenious invention by Friedrich, the well-known Director of the Research Station at Mariabrunn, in Austria. This is called the "Grimpeur," and by its means the tallest trees are safely climbed. It would be useful for measuring diameters at different heights for exact

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dendrometric purposes, or no doubt for pruning very high branches, etc. It is described as consisting of two pieces, 1½ metres long, sliding along one another. Each piece has a sort of seat at its top, with a strong, but flexible, steel ribbon fixed at one end to it, the other end being free to be passed round the tree and then fastened to the seat, holding very securely to the tree. After the apparatus has been placed against the tree and attached to it, the second piece is pulled up its full length by a special, easily worked, contrivance, and is then fixed by its steel ribbon to the bole. The first piece is then unfastened and pulled up, and so on. It is claimed that a man can work himself up, without labour, 30 feet in five minutes.

There is also a notice of the American method of felling trees by electricity and a platinum wire, which is said to burn its way through a tree, with scarcely any smoke, as easily as a knife cuts through butter. If this is really so it seems a most useful invention.

Attention is drawn to a Circular of the Prussian Government, which has been so struck with the success of the Douglas fir that it intends to extend its cultivation largely in that kingdom.

The *Revue* often has interesting reviews of forest publications —not only French forest works. For example, we find a long account of Professor Graves' (Yale) new book on Forest Mensuration. Of French books that have appeared lately, probably the most important is M. Huffel's *Économie forestière*, in three volumes. This book is probably destined to become a classic.

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15. Notes on the Forestry Exhibition at the Lincoln Show of the Royal Agricultural Society of England, held June 25th to 29th, 1907.

By A CORRESPONDENT.

This section was organised by the Royal Agricultural Society in conjunction with the Royal English Arboricultural Society, Mr George Marshall, Mr A. T. Gillanders, and Mr W. B. Havelock being responsible.

This is the fourth time that such an exhibition has been held, and there can be no doubt that it was the largest, the most interesting and best educational display of British Forestry ever seen in England.

It was decided by the Royal Agricultural Society to offer this year special medals for boards, gates, creosoted fencing, examples of damage by insects, squirrels, voles, of abnormal growths, etc., in addition to the usual Exhibition classes of previous years. The result was most satisfactory, as there were numerous entries in nearly every class, hailing from Northumberland in the north to Kent and Wiltshire in the south.

The success of the Exhibition was largely due to the interest displayed in it by the President, the Earl of Yarborough, who contributed largely from his Lincolnshire estates.

The following is a list of the principal awards in the competition classes:—

CLASS I.—Specimens of Oak, Elm, and Ash Timber grown in Great Britain and Ireland, two boards, 6 feet long, of each. (5 entries.)

Silver Medal: The Duke of Wellington, Strathfield Saye. *Bronze Medal:* The Marquis of Exeter, Burghley House. *Highly Commended:* The Earl of Yarborough, Brocklesby Park. These boards were very good indeed, particularly the English Elm.

CLASS II.—Boards of Larch, Spruce, and Scots Pine. (4 entries.)

Silver Medal: The Earl of Carnarvon, High Clere Castle. *Bronze Medal:* The Earl of Yarborough. The Larch and

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Scots Pine shown by Lord Carnarvon were perfect specimens of what such timber should be; the Spruce was rather knotty, but sound and white.

CLASS III.—Boards of any other sorts of Hardwood or Broad-leaved Timber. (3 entries.)

Silver Medal: The Earl of Yarborough, who showed beautiful boards of Spanish Chestnut, Wych Elm, Sycamore, Hornbeam, Lime, Acacia, Walnut, Scarlet Oak, Beech and Plane. The Lime, Scarlet Oak, Walnut and Hornbeam were especially good. *Commended:* The Duke of Wellington, who sent Beech, Sycamore and Spanish Chestnut.

CLASS IV.—Boards of any other Coniferous Timber. (2 entries.)

Silver Medal: The Earl of Yarborough, who showed 7 kinds, including very fine Cedar of Lebanon and Douglas Fir. *Bronze Medal:* The Earl of Carnarvon, who sent Weymouth Pine, Silver Fir, and very fine Corsican Pine, 2 feet wide.

CLASS V.—Specimens of Insect Pests injurious to Forest Trees. (4 entries.)

Silver Medal: South-Eastern Agricultural College, Kent. This was really a museum in miniature, and well deserved the first place, but no forester could be expected to compete with the resources at the disposal of a college. *Bronze Medal:* Mr A. T. Gillanders, Alnwick Park. Great credit is due to Mr Gillanders for this valuable exhibit. *Commended:* The Earl of Yarborough. Damage by Tortrix Moth (*Tortrix buoliana*) to Scots, Austrian and Corsican Pines, with specimens of the insect in its three stages.

CLASS VI.—Specimens showing comparative Quality of Larch Timber grown on different Soils and Situations. (1 entry.)

Silver Medal: Lord Burton, Burton-on-Trent, who was the only exhibitor. The difference in quality of timber from various soils was well marked.

Class VII.—Specimens showing comparative Quality of any Timber—other than Larch—grown on different Soils and Situations. (No entry.)

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CLASS VIII.—Specimens of pruning Forest Trees. (3 entries.)

Silver Medal: The Duke of Northumberland. *Commended:* Sir Montague A. R. Cholmeley, Bart. There were only three entries in this class, and, though interesting, they were not worthy of special mention.

CLASS IX.—Specimens of Stems illustrating the effects of Dense and Thin Crops in Branch Suppression and Quality of the Timber. (4 entries.)

Silver Medal: The Marquis of Exeter. *Highly Commended:* The Earl of Yarborough. *Commended:* The Duke of Northumberland. This was one of the most useful sections of the show, especially to persons interested in the growing of first-rate timber. The methods of the exhibitors varied, and it would be as well on a future occasion if some definite system could be decided upon. It is obviously difficult to show trees as they grow in a forest, as was done by the winner of the medal, who sent Ash and Larch trees 45 feet long. Lord Yarborough's exhibit comprised stems 6 feet long, and boards cut therefrom, of Austrian, Scots and Corsican Pines, Larch, Douglas, Silver and Spruce Firs: and the difference between clean and coarse timber was well marked. The Duke of Northumberland sent Scots Pine and Spruce, in 4 feet lengths, from thin and dense crops, accompanied by valuable explanatory notes as to the number of trees per acre in each case, also the volume per acre from an unthinned crop 45 years old.

CLASS X.—Examples of the Damage done by Squirrels, Voles, etc., and Abnormal Growths. (2 entries.)

Silver Medal: The Earl of Yarborough. This exhibit may be said to be unique, containing as it did specimens of fifteen kinds of Witches' Brooms, several of which have never been recorded before, and thirteen kinds of Burrs. Many of the former, such as the broom on the elder, oak, and chestnut, are very rare. The burrs also were remarkable, especially the polished specimens from the oak and English elm. Trees and tree-tops of several kinds damaged by voles and squirrels were also included, and a curious root-growth on the trunk of a beech, following damage done by fire to the bark.

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CLASS XI.—Gate for Farm or Estate Use, manufactured from Oak Timber, to be hung and shown in working order with fastening, unpainted. Prices, including the posts and ironwork, were attached to each gate, and are here given. (5 entries.)

Silver Medal: The Earl of Yarborough, 41s. 10d. *Bronze Medal:* The Marquis of Exeter, 34s. *Highly Commended:* Sir A. R. Cholmeley, Bart., 35s. *Commended:* The Earl Fitzwilliam, 41s. The first prize gate was fitted—as were all Lord Yarborough's gates—with wooden swing-fasteners and wooden catches, and hung on good oak posts; the ironwork was simple, the top-band clasping the top bar 18 inches, and the top crook reaching through the post with a nut at the back. If all persons who are responsible for the gates on estates had themselves to open them on horseback, there would soon be an end to all the various sorts of iron spring-fasteners so much in vogue. No fastener is so easily adjusted, and so easy to open on horseback, as the swing wooden ones so generally used in parts of Lincolnshire and Yorkshire. The Marquis of Exeter also showed a gate made of riven oak, which attracted much attention.

CLASS XII.—Farm Gate made from any other Home-grown Wood, unpainted. (6 entries.)

Silver Medal: The Earl of Yarborough, Larch gate hung on creosoted Spruce posts, 24s. 9d. *Bronze Medal:* The Marquis of Exeter, Larch gate, 36s. *Highly Commended:* The Earl of Carnarvon, Larch gate, 28s. The first prize gate was similar in design and fittings to the gate in the previous class, but a special feature was the creosoted spruce posts, which reduced the cost of the exhibit considerably, as well as showing the utilisation of comparatively worthless timber. The larch of which Lord Carnarvon's gate was made was of extra good quality, and without a knot. Some judges would have given it the second place.

CLASS XIII.—Wicket or Hunting Gate, self-closing, made of Home-grown Timber, to be hung and shown in working order, unpainted. (5 entries.)

Silver Medal: The Earl of Yarborough, Spanish Chestnut gate on Oak posts, 24s. 6d. *Highly Commended:* The Marquis

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of Exeter, Larch gate, 29s.; the Duke of Wellington, Folding Hunting gate, 20s. (excluding posts). *Commended:* The Earl Fitzwilliam, Larch gate on Oak posts, 30s. 6d. The folding hunting gate shown by the Duke of Wellington was so arranged that the upper half, on drawing a handle, falls down against the lower part, and though forming no obstacle to huntsmen, the remaining half is sufficiently high to prevent rabbits getting into enclosed young plantations. It is a very ingenious arrangement, but rather too complicated to be serviceable.

Mr W. Forbes, Shotwick Park, exhibited a so-called Hingeless Gate, 16s. 6d., but as a matter of fact it had hinges of a sort. The bottom of the back-head works on a coarse-threaded worm, which lifts up the gate as it opens, and the weight of the descending gate closes it again. It has a lift-up catch, which a rider would find rather difficult to open.

CLASS XIV.—Specimens of Home-grown Timber suitable for Estate purposes, manufactured or otherwise, showing the advantage of applying Creosote or any other preservative. (2 entries.)

Silver Medal: The Earl of Yarborough, who showed eight kinds of creosoted fencing used on the Brocklesby Park Estate, also creosoted Spruce gate-posts, and creosoted Larch and Oak poles with branches 9 inches long left on for climbing plants. The last-named were shown with roses in full bloom and other climbing plants trained to them, and were most effective. If the posts are allowed to dry for a time before using, no harm is done to the plants by the creosote, and the life of the post is trebled. Lord Fitzwilliam, the only other exhibitor, showed some creosoted fencing made of Scots Pine.

ARTICLES FOR EXHIBITION ONLY.

Mr Fraser Story, of the University College of North Wales, Bangor, had a large exhibit, comprising planks, boards, and transverse sections of Larch, Douglas Fir, and *Thuia gigantea:* hand-specimens of sixty different species of European woods, abnormal growths, damage done by squirrels to larch and birch, photographs demonstrating Continental forestry, specimens of damage done by various insects and diseases, etc., etc.

Included was a large well-hearted plank of Douglas Fir, 2 feet across, showing rapid growth but coarse quality. It was

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grown on the Earl of Powis's estate, in a very thin wood, at an elevation of 1000 feet.

The Earl of Yarborough showed a splendid collection of boards 7 feet long, of 80 different species, grown on his estates, with photo-micrographs of transverse sections, at a magnification of 10 diameters, showing structure of the timbers. These were much admired, as such a collection from one estate had not been attempted at any previous Exhibition. Also hand-specimens of 167 different species of home-grown woods, all polished and labelled; 49 photographs of the Brocklesby Woods, illustrating the evolution of forestry from the nurseries through the woods, and back to the creosoting plant; lists of trees planted during the past 121 years, amounting to a total of 23,828,316 trees; particulars and specimens of different tests, showing absorption of creosote oil by 27 and 56 kinds respectively, of home-grown woods, in the round and in scantling, and the loss of weight in seasoning. Also samples of creosoted and uncreosoted fencing, which had been in use 11 years, on sandy, clayey, and chalky soils, demonstrating the remarkable preservative effect of creosote on Spruce and other low-priced timbers. This part of the exhibit was most valuable to all owners of woods, demonstrating as it did the practicability of using at home for estate purposes all immature and rough timber, and selling only the best kinds. Included were also cast-iron date-pillars for young plantations; galvanised number nails for driving into timbers, to fix the date of creosoting or erection; a selection of forestry tools, etc.

Messrs Wm. Barron & Son, Elvaston Nurseries, had on view one of their tree-transplanting machines, which are now so well known.

Mr W. Forbes, of Shotwick Park, exhibited a timber book, timber table, etc., which are useful to foresters.

Messrs Richardson & Son, of Stamford, sent 13 fine photographs (framed in brown oak) of some noted oak trees which they had sold, and the recorded prices of the same; and also a superb piece of brown oak veneer, highly polished, showing the grain of the timber to perfection.

A very interesting exhibit, to the younger generation, was that of Messrs John Wisden & Co., London, showing six stages of the cricket bat, from the rough willow-timber to the finished article.

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A collection of Willows, etc., suitable for basket-making, was sent by Sir Montague A. R. Cholmeley, Bart.

Mr Geo. Marshall exhibited specimens of common and Japanese Larches, which made out that the latter grew the quicker in its earlier stages.

Adjoining the Exhibition, several of our leading nurserymen had large spaces planted with conifers and ornamental trees and shrubs. There has seldom been seen at any Show a wider variety of plants, more tasteful grouping, and more striking and beautiful foliage. The chief exhibitors were Messrs Little & Ballantyne, Carlisle; Messrs Fisher, Son & Sibray, Ltd., Sheffield; Messrs James Backhouse & Son, Ltd., York; Messrs Kent & Brydon, Darlington; and Messrs Pennell and Sons, Lincoln.

It need only be added that the Exhibition was worthy of the place and the occasion, and should awaken a greater interest in the cause of British Forestry. Thousands visited this Section during the five days, and evinced an uncommon appreciation of it.

Professor Somerville, of Oxford University, acted as judge, and his decisions were received with practical unanimity.

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16. Report on the Forestry Exhibition held in the Highland and Agricultural Society's Showyard, Prestonfield, Edinburgh, 9th-12th July 1907.

By A CORRESPONDENT.

The Society's seventh Annual Exhibition of Forestry, which was this year held in the Highland and Agricultural Society's Showyard at Prestonfield, may be fairly claimed to have been the best of its kind that has yet taken place. There were altogether 19 competitions for which prizes were offered, and, in addition, the usual invitation was extended to members and others to send articles for Exhibition only. In the competitive department there was only one section in which there was no entry; in eight there was only one entry; but in all the others there were several entries. The Directors of the Highland and Agricultural Society, as in previous years, kindly voted the sum of £20 for prizes to be awarded for home-grown timber, and the Royal Scottish Arboricultural Society offered a large number of medals as prizes in the other competitions, besides authorising the Judges to recommend medals or other awards for interesting exhibits not sent for competition.

The prizes offered for timber were distributed over 4 competitions, in which there were 16 entries. The competitors were the Duke of Roxburghe, the Earl of Mansfield, Captain Stirling of Keir, Mr J. A. Stirling of Kippendavie, Mr Bryce Allan of Aros, Sir Duncan E. Hay, Bart. of Smithfield and Haystoun, and Mr H. J. Younger of Benmore. The timber exhibited in all the competitions was exceptionally good, and was generally admitted to have been the best yet shown at any of the Exhibitions. The Scots pine, larch and spruce planks that were awarded the first prize in the first competition were unique in quality and dimensions, but all the lots were of a very high standard. The second competition, which was for planks of three coniferous timber-trees other than those in Competition I., embraced planks of silver fir, Menzies spruce and Douglas spruce from Scone, and of *Abies nobilis*, *Abies amabilis* and *Pinus insignis* from Benmore. All the boards were fine specimens, but those in the second lot were specially attractive on account of their novelty. In the third competition for ash, oak and elm, the oak in the lots which were awarded the first and second prizes was

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very fine. The feature of Competition IV., which embraced the other hardwood timbers, was the excellence of the beech in the lot which obtained the first prize, while the birch in the lot which was placed third was unusually good. In the competition for specimens of the fruits of trees, a very interesting collection of mounted specimens was sent by Mr John Patten, jun., Hulne Park, Alnwick. Mr Fred Moon, Forester to the Duke of Roxburghe, sent an instructive exhibit of the damage done by the pine saw-fly, an unusual feature of the exhibit being the live specimens at work. The Duke of Roxburghe, the Earl of Mansfield, and Captain Stirling of Keir sent farm gates; and Mr Fothringham of Murthly, the Duke of Roxburghe, Mr Alex. Pollock, Tarbolton, and the Earl of Mansfield sent self-closing wicket gates manufactured from home-grown timber. The first prizes in these competitions were awarded to the Earl of Mansfield, both of whose gates were much admired, though it was generally remarked that the cost indicated upon them appeared to be too moderate. Mr Fothringham's wicket gate had also many admirers. Mr Alex. Pollock exhibited along with his wicket gate a full sized section of a rustic fence made from larch thinnings.

In the competition for specimens showing the comparative quality of larch timber grown on different soils and situations, and the respective ages at which it reached marketable size and maturity, interesting specimens were sent by Captain Stirling of Keir and the Duke of Roxburghe. The latter also sent similar specimens of Scots pine, ash and spruce, which were well set up for inspection. The specimens of larch exhibited by Captain Stirling showed remarkable growth.

In the competition for specimens illustrating the beneficial effects of pruning when well done and its injurious effects when badly done, the Duke of Northumberland's exhibits were exceedingly well chosen, well labelled with descriptive accounts, and attracted a great deal of attention.

The Duke of Roxburghe and the Duke of Northumberland were also competitors with stems illustrating the effects of dense and of thin crops in branch suppression and quality of timber. The Duke of Roxburghe's specimens consisted of two samples of spruce, one with foliage down to the ground and the other showing a long clean stem. The Duke of Northumberland's exhibit included a specimen of Scots pine, taken from a wood

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planted 4 feet apart, showing side branches much developed, which would be expected to produce knotty timber like a sample exhibited; and a similar tree taken from a plantation where the plants had been put in 3 feet apart, showing side branches with small development, which would be expected to yield in course of time clean timber similar to a board exhibited. These two specimens were further illustrated by diagrams of cross sections showing the strong branches projecting a long way into the timber from the centre in the one case and a very short distance in the other. Examples of the damage caused by too heavy thinning were also exhibited in this section by the Duke of Northumberland.

Mr Alex. Pollock, Tarbolton, sent a set of rustic chairs made from small oak-wood grown on the banks of the Ayr, and the Earl of Mansfield an interesting exhibit of turnery, which was entered under the competition for the best methods of utilising home-grown small wood. Both exhibitors, however, omitted to send samples of the round wood from which the exhibits were manufactured.—Mr Alex. Murray, Forester, Murthly, showed a collection of fungi injurious to forest trees and shrubs; while the Duke of Roxburghe sent samples of young trees damaged by squirrels and voles, with stuffed specimens of these pests.—The photographs of a forest tramway exhibited by the Duke of Roxburghe, which were accompanied by a descriptive report, were very interesting and instructive to practical foresters, wood merchants and others connected with the transport of timber.—In the general competition for any approved article either wholly or mainly made of wood, Mr Willian Sinton, jun., exhibited a neat plant-tub made from Jed Forest oak, and Mr Alex. Pollock a rustic seat made from home-grown oak.

In the non-competitive section of the Exhibition, Dr Borthwick, the Society's Honorary Cryptogamist, had an extensive collection of twigs and cones of conifers; and he also exhibited three newly-discovered fungi, of which he was kind enough to give an account at the General Meeting of the Society. (See note in the Proceedings of the General Meeting.)—The Society's collection of sections of British timber and photo-micrograph slides were again on view; and Mr James A. Weale, timber merchant, Liverpool, was kind enough to lend the photo-micrographs which were exhibited at Peebles last year, and were then awarded the Society's gold medal. Mr Weale's

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collection this year included several new photographs.—Captain Stirling of Keir exhibited three large photographs of historical trees.—Mr Munro Ferguson, M.P., sent plants from his nursery at Novar, showing the good effects of transplanting when well done and the bad effects when badly done.—Mr James R. Barton, factor, 61 Frederick Street, Edinburgh, exhibited, in a neat case, specimens of the pine saw-fly and of the willow-moth in their various stages, along with the parts of the Scots pine and willow damaged.—Mr Alex. Murray, forester, Murthly, sent a very fine collection of 167 different varieties of tree-seeds well displayed for exhibition, with a descriptive report as to the best methods of collection and extraction.—Messrs Dicksons & Co., nurserymen, Edinburgh, exhibited a valuable set of tools used in forestry, a collection of cones, and a large number of transverse and longitudinal sections of timber of the principal forest trees illustrating the appearance of the wood.—The Earl of Mansfield had on view a large number of very fine planks of both coniferous and hardwood timbers, and also cross sections of various conifers grown on his estates, suitably labelled with particulars as to the age, volume per acre, and rate of growth. He also sent a set of tools and implements used in forestry operations, and a hunting wicket-gate made of split oak.—Mr Gillanders, forester to the Duke of Northumberland, had an instructive exhibit of turf and soil illustrating the advantages of pasturing woodland or waste land by stock previous to planting. The turf was in two divisions, one showing the rough heather previous to being pastured, and the other the grass from which the heather has almost disappeared after having been pastured for two years. He also sent a number of cases containing insects injurious to forest trees, with samples of the damage caused by them. A feature of this collection was the excellent way in which the specimens were labelled and described.—Lady Fowler, Inverbroom, Garve, sent a portion of a log of beech timber removed from the foundations of the choir of Winchester Cathedral in 1907, during the process of underpinning and the insertion of a new sub-foundation, rendered necessary in consequence of the subsidence of the structure. The logs were found to be laid horizontally and not driven as piles, at a depth of about 12 feet in a bed of chalky marl, fully charged with water, and overlying a peat-bed some few feet below. The logs were supporting the foundations of the main walls and piers of

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the structure erected by Godfrey de Lucy (bishop, 1189-1204) in the reign of King John, and must therefore have been in position some seven hundred years. A framed plan of the foundations of the choir was also on view.—Mr John Methven, Edinburgh, showed a small piece of oak taken from the stern-post of H.M.S. "Victory," and a small piece of Scots pine taken from Ballochbuie forest.—Mr Adam Spiers, timber merchant, Edinburgh, exhibited a remarkably fine plank of brown oak from the old Caledonian Forest, Dalkeith; a white beam of unusual size; a plank of sycamore of excellent quality; a very large plank of beech; a plank of Siberian larch; and a large larch tree grown on Yester estate, containing over 100 cubic feet of timber, and 110 years old.—Messrs Mackenzie and Moncur, Ltd., exhibited a plank of larch imported from Northern Russia, which was much admired. This timber is now being experimented with as a substitute for red wood in hothouse building.—Mr David W. Thomson, nurseryman, Edinburgh, was good enough to send the fine collection of ornamental trees and shrubs which decorated the Society's enclosure.

The Exhibition attracted a large number of visitors each day, and on the Thursday afternoon the Society was honoured by a visit to the Exhibition from H.R.H. the Prince of Wales and his suite, including the Duke of Buccleuch, Lord Tullibardine, Lord Rosebery, Lord Lovat, and other members of the Society. Mr John Methven, who had been presented on the previous day, received His Royal Highness, and presented the secretary, Mr Robert Galloway, S.S.C., who had the honour of explaining the principal exhibits to the Prince. His Royal Highness showed great interest in all the objects brought under his notice, and expressed himself as much pleased with what he had seen. Mr Methven thanked the Prince for his visit.

The thanks of the Society are due to Messrs Broom, Crozier, and Macbean, the judges, for the expeditious and satisfactory manner in which they carried out their difficult duties, and to the committee for the trouble taken by them in connection with the arrangements. Special thanks are due to Mr M'Hattie, convener of the committee, for providing the attendants, and to Mr Spiers, who was present not only during the whole of the Exhibition, but also before it opened and after it closed, in connection with the staging and removal of the exhibits.

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17. The Thirtieth Annual Excursion, August 1907.

(With Plate.)

The Thirtieth Annual Excursion of the Royal Scottish Arboricultural Society was held on 6th, 7th, 8th and 9th August 1907, in the district of Speyside, permission to visit estates there having been kindly granted by the Dowager Countess of Seafield, His Grace the Duke of Richmond and Gordon, Sir George Macpherson Grant, Bart. of Ballindalloch, Mr J. W. Wharton Duff of Orton, and Mr John R. Findlay of Aberlour. Elgin was the headquarters of the Society during the tour.

FIRST DAY.—Seafield Estates (Castle Grant District).

A special train conveyed the members to Grantown, where they were welcomed on Lady Seafield's behalf by Mr J. Grant Thomson, wood manager on the estates, who put into the hands of the members a printed programme for the day, which he had very kindly prepared for their use.

One of the most noteworthy features in Strathspey forestry being the extent to which natural regeneration is carried on, the programme included visits to woods raised by that method. In a Scots pine wood of 16 acres, and about 100 years of age, beside the Highland Railway Station at Grantown, the first stage of regeneration was seen. This wood was recently enclosed, and young natural plants are now appearing among the heather, the presence of which indicates that the conditions are suitable for the natural growth of Scots pine. In certain parts the turf had been upturned, so that the exposed soil might catch the falling seed, and offer it a germinating bed. But the cold and backward weather of the present year having delayed the opening of the cones, fewer young plants were visible than would have appeared in an average year, though on several of the exposed surfaces young seedlings of this year's growth were observed.

The party then drove to Kylintra Saw-mill, and walked along the public road which intersects woods of about 70 acres in extent. On the left was a thriving young crop of natural Scots pine, growing between and below the old parent trees; on the right, where the old trees had nearly all been cleared away, was a dense natural crop about 70 years old.

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After driving through Grantown village, the members saw on their left Lynmacgregor Wood, which consists of a mixture of larch and Scots pine about 50 years of age. This was originally a planted wood, and the larches still survive, but the pines were eaten by rabbits and beetles. A natural crop of pines then came up, and the ground is now excellently covered by them. Farther north, Lynmoor Wood, which was enclosed in 1877, and consists of a natural crop of larch and Scots pine, was visited. Unfortunately, time prevented more than a passing look at this thriving wood.

Returning, the party drove to Castle Grant, which, by the kindness of Lady Seafield, who personally welcomed them, they were permitted to visit. Milton Wood, extending to about 38 acres, was next visited. It is said to have been originally planted with young natural trees carted from Abernethy forest, and is believed to be now between 150 and 200 years old. It affords a view, probably unequalled, of lofty valuable Scots pine trees. Spruce, as well as Scots pine and larch, grows naturally in Strathspey, and two groups of spruce thus raised were seen from the carriages on the way back to Grantown. On reaching Grantown the visitors were hospitably entertained to lunch by Lady Seafield; after this the Scots pine woods of Drumindunan and Anagach were inspected. The former, which is said to be the oldest planted wood on the estate, exhibits various stages of the growth of the pine, from the largest timber-trees down to naturally sown seedlings. The wood of Anagach also contains an extensive and thriving crop of natural trees. Over two hours were devoted to the inspection of these woods. In the evening the members dined together in the Grand Hotel, and afterwards an informal discussion, opened by Dr Borthwick, took place on the effects of smoke on trees.

SECOND DAY.

The programme for this day included visits to Mr Wiseman's nurseries and to the estates of Orton and Gordon Castle.

Wiseman's Nurseries.

The party left Elgin in the morning, driving to Mr Edward Wiseman's extensive nurseries, where an enormous quantity of young trees of various species, in which the Scots pine and the

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FIG. 1.—In Curr Wood, Seafield Estates, Strathspey.

John Smith, Factor, Grantown. | J. Grant Smith, Factor, Elgin. | Rev. Wm. Thomson, B.D., Grantown. | J. Grant Thomson, Wood Manager, Grantown.

FIG. 2.—Grig Wood, Orton. Probable date of planting, 1780-85.

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larch predominate, are raised. The nurseries, which give employment to a large number of men and women, are beautifully kept, and the whole stock appeared to be in a very healthy and vigorous condition. After spending about two hours in the nurseries, the party drove on to

Orton,

where they were met by Mr and Mrs Wharton Duff of Orton, who had very kindly drawn up a programme for the visit. Mrs Wharton Duff, who is a daughter of the late Mr John Ord Mackenzie, one of the founders of the Society, is keenly interested in arboriculture, and personally conducted the party over several of the woods on the estate. The district, which contains many interesting features, presents a marked contrast to the Seafield estate visited on the previous day. The Darnot Hill Wood, composed of a mixture of Scots pine and larch, was planted about 1770, and contains some magnificent timber. The trees are of great height and girth, and rise straight and smooth as telegraph poles for a considerable proportion of their height. On the north-east and more exposed side of the wood there were signs of larch canker, and so much damage was done by rabbits and squirrels that it had to be replanted at different times. Professor Somerville, in the course of a few remarks addressed on the spot to the members, said that the trees had practically overcome the disease, and that they were now likely to grow into valuable timber. The Grig Wood, planted about 1780, also contained some very fine trees of pine, larch, spruce, beech and other species (see Plate X. Fig. 2). Mr and Mrs Wharton Duff kindly entertained the party to luncheon in the Mansion House, and afterwards the members drove to

Gordon Castle,

where they were met by Mr Muirhead, the Duke of Richmond and Gordon's commissioner, Mr Cunningham, factor, and Mr Webster, forester and gardener. The deer-park was first inspected, several very fine specimens of Scots pine and larch attracting particular attention. Some of the larches showed a girth of 12 feet. An enjoyable walk down the Glen by Wishartstown brought the party to the Castle, near which the Duchess tree and several large specimens of yew and lime

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trees were measured. After tea, which was kindly provided by the Duke of Richmond and Gordon, the members were shown round the gardens, which were greatly admired.

The Annual Excursion Dinner was held in the Grand Hotel. The President, Sir Kenneth Mackenzie, was chairman, and Mr Fothringham, vice-president, was croupier. The guests of the evening included Bailies Davie, Wilson and Gordon, Mr Hugh Stuart, Town Clerk, and Mr J. Grant Smith, factor, Elgin.

THIRD DAY.—BALLINDALLOCH.

The party at Ballindalloch Station were received by Mr John Macpherson Grant, Younger, of Ballindalloch. Sir George Macpherson Grant, Bart., received his guests at the end of the bridge over the river Avon, and gave them a most hearty welcome. The members then passed along the avenue, which is lined on both sides with magnificent larch and other trees. A splendid specimen of *Abies nobilis* attracted great attention. At 5 feet from the ground it girthed 9 feet 11½ inches, and its height was estimated at 94 or 95 feet. This specimen was considered by the company to be the largest in girth in the kingdom, the only one approaching it being found at Murthly,—this girths only 7 feet 11 inches, but it is said to be a little over 100 feet in height. Sir George informed the company that this tree was planted in 1859 or 1860. A Douglas fir, with great outspreading branches, a number of which trailed on the ground, girthed 12 feet 8 inches, and was about 90 feet high. Sir George stated that it was planted in 1846. There were a number of excellent hardwoods—ash, limes, beeches and chestnuts—which were considered to be the finest the members had seen since they came north. The company were hospitably entertained to luncheon by Sir George.

ABERLOUR.

An enjoyable drive along the banks of the Spey brought the Excursionists to Aberlour House, where they were entertained by Mr and Mrs J. R. Findlay. A brief visit was made to the policies and beautifully laid out gardens, many notable trees being inspected in the policies. The home farm was also visited. The members then returned to Elgin.

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FOURTH DAY.—Seafield Estate, Abernethy.

The party started early for Cromdale Station, where they were again met by Mr Grant Thomson and other estate officials. As in the case of the first day's excursion, Mr Thomson had kindly prepared a programme. Tominourd, a long hill about two miles north from Cromdale Station, rising to about 800 feet above the level of the Spey and about 1400 feet above sea-level, was first visited. An area of 1030 acres was planted in 1826, the plantation being about seven miles in circumference. It was enclosed in 1865 for the purpose of being naturally regenerated, and it now carries an exceptionally thriving young crop of larch and Scots pine. Parent trees are still standing from the base to the summit, but in course of time, as the seedlings grow up, these will be removed. Seedlings were seen of a year or two's growth, their heads just appearing above the heather, while others were a foot or two higher; but there were numbers of acres carrying trees which had reached a height of from 8 to 15 feet. They were all looking vigorous and healthy. When the wood was first thinned to allow the seedlings to spring up, sheep were allowed to pasture on the hill. Trees will not thrive under such conditions. When snow covers the hills and the herbage is scarce, the sheep are obliged to eat their tender shoots, with the result that the leaders disappear. In time new leaders appear, but valuable years are thus lost; and as it is acknowledged that sheep must be banished in order to ensure healthy and vigorous trees, about six years ago sheep were excluded from this hill. The effects of the nipping off the tops are still seen, particularly in the larch, but the greater proportion of the young pine trees have got their new leaders, and the older larches have quite reasserted themselves. There were many spots of considerable area where no seedlings were visible, but it was said that time only was required to clothe the whole hill from top to bottom with a forest of trees as thick as they could possibly grow.

After leaving Tominourd the party drove about nine miles up the banks of the river Spey to see the natural woods of Skye and Curr. The former was merely examined from the road, as there was no time to make a more careful inspection of it. Curr plantation (see Plate X. Fig. 1) was, however, carefully examined. It extends to 250 acres, and was enclosed in 1874. It contains

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a natural crop of Scots pine, and also some larches produced by natural regeneration. The ground is so well covered that the soil and climate must be exceptionally favourable. No thinning has been done, though dead stems have been removed for firewood, and no thinning will be made until it becomes commercially profitable, Nature, which raises the crop, being left to do the thinning, the strong plants in course of time smothering the weak. M. Boppe visited this forest amongst others in 1881, and in the course of his report said: "It is easy in Scotland to perpetuate a forest by natural means, and of this a practical proof was given us in two forests which we visited, one near Grantown in Strathspey, the other at Beauly. In these the results obtained under the skilful and intelligent direction of the gentlemen who manage these forests for their employers form a striking example of what may be done in the way of reproducing forests by natural means. In fact, nothing had been neglected which even the most critical forester could desire; the gradation of age was here complete, and the reservation of specially vigorous trees of known pedigree, duly carried out" (see *Transactions*, Vol. XI. p. 202).

The large majority of the members had not had an opportunity of seeing natural regeneration before as carried out in the north of Scotland, and few were aware that such perfect examples as they had had the privilege of inspecting that day existed in the country.

After leaving Curr, Balgowan Wood was inspected. This wood was enclosed about seven years ago, and contains a natural crop of Scots pine seedlings, in vigorous condition, which will soon quite cover the ground. On reaching the nursery they partook of lunch, kindly provided by Lady Seafield. After inspecting the nursery, the party drove through part of the old Abernethy forest, which is a very extensive area of Scots pine of all ages. The part of the forest passed through was once devastated by fire, but is now all covered with a vigorous natural crop, though a few of the old trees which survived the fire are still visible. It was estimated that some of the older trees were over 300 years of age.

The party then drove to Nethy Bridge Station, where they took train for the south.

The following is a list of the members who took part in the Excursion:—Sir Kenneth Mackenzie, Bart., *President;* Robert

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Allan, Polkemmet; Dr Borthwick, Edinburgh; John Boyd, Pollok; John Broom, Bathgate; Charles Brown, Kerse, Falkirk; Gilbert Brown, Kiltarlity, Beauly; Thomas Bryden, Ayr; Charles Buchanan, Penicuik, *Convener;* H. M. Cadell of Grange, Bo'ness; Thomas Christie, Forres; William Christie, Fochabers; Robert Cowan, Erchless, Strathglass; R. W. Cowper, Gortanore, Sittingbourne; Alfred G. Crabbe, Craigo, Montrose; John D. Crozier, Durris, Drumoak; W. S. Curr, Ninewar, Prestonkirk; Evan J. Cuthbertson, Edinburgh; William Dick, Hamilton; Walter Elgar, Hillside, Sittingbourne; James Forbes, Overtoun, Dumbarton; Robert Forbes, Kennet, Alloa; W. Steuart Fothringham of Murthly; Alex. Fraser, Inverness; Robert A. Fraser, Edinburgh; Robert Galloway, 19 Castle Street, Edinburgh, *Secretary;* Arthur P. Grenfell, London; George Halliday, Rothesay; James S. Keir, Raith, Kirkaldy; Robert Laird, Edinburgh; George Leven, Auchincruive; A. Lockhart, Huntly; Rev. J. S. Loutit, Foveran, Aberdeen; S. Macbean, Erskine, Bishopton; G. U. Macdonald, Haystoun, Peebles; Gilbert R. M'Garva, Innes, Elgin; J. W. MacHattie, Edinburgh; James Mackenzie, Inverness; John M'Kerchar, London; Donald M'Laren, Sundrum, Ayr; W. H. Massie, Edinburgh; Alex. Milne, Edinburgh; Alex. Morgan, Crieff; Andrew Morrison, Brodie, Forres; Alex. J. Munro, Edinburgh; George A. Munro, Edinburgh; A. D. Page, Culzean, Ayr; James Porteous of Turfhills, Kinross; W. M. Price, Minto, Hawick; W. Ralph, Corstorphine; John Rule, Huntly; H. Rutherfurd of Fairnington, Roxburgh; David T. Samson, Grantown; Thos. Sharpe, Monreith, Port William; James Shiel, Abbèy St Bathans, Grant's House; Professor William Somerville, Oxford; Adam Spiers, Edinburgh; W. J. Stalker, Nairn; James Stoddart, Bonnyrigg; Robert Taylor, Broomhill, Charlestown; J. Grant Thomson, Grantown; James W. Watt, Carlisle; John Williamson, Grangemouth; David Wilson, Troon; Edward Wiseman, Elgin; George Wolfe, Bathgate; E. M. Worsfold, Dover; William M'Nae, Munches, Dalbeattie; Arthur M. Sleight, Brighton; Rev. W. B. Sleight, Northampton; F. Simmonds, M.V.O., Kensington; James Tait, Penicuik; D. Macmillan, Keir, Dunblane; W. Ramsay of Longmorn, Elgin; Daniel Scott, Darnaway, Forres; Alex. Robson, Aberdeen; William Mackenzie, Novar.

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NOTES AND QUERIES.

The Forestry Committee (1902) and Training in Forestry.

The Forestry Committee (1902) contemplated that the training in forestry of persons requiring it would be arranged as follows:—

1. *Future Owners and Agents, to be Trained at Universities and Provincial Colleges.*—The Committee considered that the scope and character of the instruction then given at the Edinburgh University was the least that should be aimed at, though it might with advantage be carried considerably further; and that better instructional facilities, including a Forest Garden, should be provided. Since the Committee's report was written, a Degree in Forestry[1] has been instituted at the Edinburgh University, with an advanced course in Forestry, and with new special courses in Forest Botany, Forest Entomology, and Forest Engineering. This involves two years' study at the University, and a third year occupied in practical work abroad.

It may be confidently anticipated that when work at Inverliever and in the Highland and Lowland State Demonstration Forests is fairly started, the financial potentialities of scientific forestry will become more generally recognised than they are at present; and that as soon as Bachelors of Science in Forestry have gained sufficient practical experience to be entrusted with a responsible charge, the owners of large estates will, when filling vacancies on their staff of factors or wood-managers, give them a preference, and will be willing to offer salaries sufficient to attract such men into their service. When this comes about, there will be no lack of candidates for the Degree, a further inducement to take which will be found in the better prospect it will secure of highly paid colonial employment.

2. *Men who propose to take up Land Agency as a profession, but who cannot afford to spend Three Years at a University.*—This class to be trained at Agricultural Colleges, by courses similar to those at the Universities. In this connection the Committee say: "Inasmuch as Land-Agents are entrusted with the management of large estates, which usually comprise a certain area under

[1] For further information regarding the Degree, see *Transactions*, Vol. XX. p. 248.

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wood, it is clearly requisite that they should know how to turn that area, as well as the land under other crops, to the best account." The ordinary, or lower, course in Forestry, as given at the University of Edinburgh, which will include practical instruction in the Forest Nursery and the Forest Garden, when these necessary adjuncts have been provided, now forms part of the curriculum of the College of Agriculture. It is this year attended by 13 students, of whom 5 are from the College. That course, taken together with other relative courses at the University or the College of Agriculture, and with six months spent in a State Demonstration Forest, will meet the case of candidates for Land-Agencies who may be unable to enter a University. And it may safely be predicted that the day is not far distant when the proprietors of even moderate-sized estates will require both their Factors and their newly-appointed Head Foresters to possess at least the above qualification. Orthodox views on the subject of forest management are spreading with remarkable rapidity; and it may be expected that, even without the prospect of an immediate rise in the salary and position of the Head Forester, a considerable number of candidates for that office will before long come forward to follow the curriculum above indicated. But men who have passed creditably through it will certainly be found worthy of improved positions, and their employers will find it to their own advantage to offer them better prospects than they have at present.

3. *Young Working Foresters and Woodmen.*—The training of this class to be provided for in one or other of the following ways:—

(*a*) Selected students to receive two years' training at a school to be established within a State Demonstration Forest, where they will receive regular wages and perform manual work, supplemented by theoretical study. Outsiders to be admitted on payment of a small fee.

(*b*) Men unable to leave their posts to take the above, or whose prospective salaries do not justify their attendance for any length of time at Universities or Colleges, to be offered short courses, suited to their needs, by the Agricultural Colleges. A short course of evening lectures is now given at the East of Scotland College of Agriculture, and is being followed during the current year by 27 students, among whom are numbered

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young men from factors' offices who are in training for land-agencies. The average attendance during the past three years has been 28. This course is in every way suited for the class of men indicated under this head by the Forestry Committee. It serves as a valuable introduction to the higher courses referred to above.

(*c*) For the benefit of men who may not be able to attend either of the above courses, lectures to be given, under the auspices of County Councils, in neighbourhoods where woods are numerous; scholarships and bursaries being offered in these counties to enable men who attend the lectures to enter for higher courses of instruction. Such lectures have, for the past three years, been given at various centres, the average annual total number of students having been 115. The classes have included factors, head foresters, assistant foresters, gardeners, and others interested in the subject.

F. BAILEY.

FIRST STEPS AT INVERLIEVER.

Many questions are being asked as to the future of Inverliever, but the problem is one that may be summed up quite tersely. The first step is to put the whole organisation of the 12,000 acres under the most competent forest officer that can be found. This functionary should visit Inverliever at least quarterly.

The second is to appoint a competent Advisory Board of four or five level-headed timber-growers or managers,—not to assume any responsibility, but to advise on the practical application of the plan to local conditions, and to offer suggestions for its modification or improvement for the consideration of the forest officer as occasion may arise. They might possibly have some authority delegated to them, but their chief function would be to keep the expert in touch with practical necessities, so that he would have all information before him on which to make his decisions.

The third step is to appoint a local foreman, who is likely to plant at the lowest effective expenditure and with the fewest deaths, and could be relied upon to carry out intelligently the directions he receives.

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N.B.—This foreman should either be a first-rate nurseryman, or he should have a first-rate nurseryman under him, for the financial success of the undertaking will depend mainly on efficient nursery work in the first instance, and on the economical transfer of the plants from the nursery to the new plantations.

R. C. MUNRO FERGUSON.

NOTE ON DAMAGE TO A YOUNG CONIFEROUS PLANTATION BY WATER-VOLES.

The attack occurred in April and May of 1907 in a five-year-old plantation of Scots pine, spruce, and larch, with an admixture of hardwoods, on the Broxmouth Estate of His Grace the Duke of Roxburghe, and was brought to my notice by my assistant on that property. A burn flows through the plantation.

Recognising at once the work of voles, I instructed my assistant to at once set traps in their underground runs, and to try poisoned bait set in drain tiles; and as I was returning home that day, I desired him to send me a specimen of his catch. I was agreeably surprised the following morning when a water-vole (*Arvicola amphibius*) arrived by post.

A couple of dozen Scots pine and several spruce and larch plants were damaged, the damage consisting in the smaller roots of these plants being entirely eaten, and the bark stripped off the larger roots and underground part of the stem up to the collum.

The underground runs of the water-vole are about two and a half inches in diameter, and close to the surface of the ground. A curious point in this case is in regard to the means taken by these animals to dispose of the excavations from so large a hole, as no trace of these could be found. The voles are very fond of sunning themselves on a warm day, and may at these times be surprised and killed by an active man with a stick.

As already mentioned, the plans adopted to destroy the animals were poisoned bait set in drain tiles and steel traps. The former was not a success, possibly owing to the bait used being bread. Had grain been used instead, better results by poisoning would probably have been obtained.

Trapping, however, was so successful, that poisoning was

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abandoned in favour of that mode of destruction. The procedure was to set ordinary steel rabbit traps in the bottom of the underground runs, blinding the traps with chopped grass, and covering over with a sod the hole made in the roof of the run to admit the trap. This served the double purpose of excluding the light and marking the positions of the traps. Up to August about forty voles were trapped, about half of them being gravid females. In addition to these, the forester's spaniel has killed several.

The infested area, where the damage was detected, is a small piece of haugh land lying between the burn on one side and a steep brae with a terrace on the top. At first the catches were at the rate of two or three each day; gradually this rate decreased, and at the date of writing (August), while there are still voles in the plantation, they have been driven from their original haunt in the haugh to the higher ground, and are not now easily trapped. No damage to the plants has been done since the end of May. Next year, should we experience a recurrence of the attack, I intend trying bait treated with "Danysz Virus" and set in their underground runs, in addition to harrying them with traps. What I particularly wish to emphasise, however, is not the trifling amount of damage done, but the prompt and successful action of my colleague, which has prevented what might have been a serious attack by these destructive rodents.

FRED MOON.

AN IRISH FORESTRY COMMITTEE.

The Vice-President of the Department of Agriculture and Technical Instruction for Ireland has appointed a committee to inquire into and report upon certain matters relating to the improvement of forestry in Ireland. The committee consists of the following members:—Mr Thomas Patrick Gill, secretary of the Department of Agriculture and Technical Instruction for Ireland (chairman); Lord Castletown; Mr William Redmond, M.P.; the Most Rev. Dennis Kelly, Lord Bishop of Ross, member of the Agricultural Board; Mr Hugh de Fellenburg Montgomery, member of the Agricultural Board; Mr William Frederick Bailey, one of the Estates Commissioners; Mr William Rogers Fisher, M.A., delegate for instruction in forestry at the Univer-

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sity of Oxford; Professor John Rich Campbell, assistant secretary in respect of agriculture of the Department of Agriculture and Technical Instruction for Ireland. The terms of reference are to inquire into and report upon the following matters relating to the improvement of forestry in Ireland—viz., (1) the present provision for State aid to forestry in Ireland; (2) the means whereby, in connection with the operation of the Land Purchase Acts, existing woods may be preserved, and land suitable for forestry acquired for public purposes; and (3) the financial and other provisions necessary for a comprehensive scheme of afforestation in Ireland. The committee began its sittings in October.

Rural Employment in Ireland and Re-Afforestation.

A writer in the *Timber Trades Journal* calls attention to some points in regard to the condition of the forests of Ireland which are of great importance. The existing forests of that country are, owing to a variety of causes, being destroyed at an alarming rate, and there is little hope that this state of affairs will be remedied by private effort. In the first place, the woods in many parts are being ruthlessly destroyed by the prevalence of temporary businesses in the shape of portable saw-mills, which, as a rule, belong to English firms, and which are not undertaken with the idea of establishing a permanent industry which may benefit the locality. Again, the tenant farmers who become owners under the Land Commission in many cases sell out the timber immediately on taking possession of the land, and this without having any intention of replanting. An increasingly widespread interest is, however, now manifest in the country, and this is mainly due to the disinterested and strenuous action of the Irish Forestry Society. They have succeeded in rousing the interest of the Agricultural Department to the possibilities of re-afforestation, but as yet no adequate steps have been officially taken towards the realisation of these ideas. It is rightly felt that in Ireland, owing to the state of the Land Question, the matter rests almost entirely in the hands of those particular bodies responsible for the buying out of the lands from the present owners, that is, such bodies as the Estates Commissioners and the Congested Districts Board. No amount of private

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enterprise, no matter how enthusiastic or whole-hearted, could raise the large capital required for carrying out a scheme of afforestation extensive enough to be of benefit to the country as a whole.

The great need over large tracts in Ireland is for rural employment; and if fairly extensive tracts of land were acquired in different parts of the country by a Forestry Board under State control, a remunerative livelihood for a large number of able-bodied young men would be established in the draining, fencing, and general preparation of the land, and in the tending of the trees after they were planted. Coniferous building timbers are yearly increasing in price, owing to the exhaustion of foreign and colonial timbers near the sea-board, and it is time that the critical position of our whole timber-supply was realised. Ireland, with its bogs, its plains, and its hill-sides lying dormant and crying aloud for exploitation, stands ready for a scheme of afforestation that shall fulfil the purposes of giving employment where it is needed, of supplying a demand for timber that will be badly wanted, and of securing a good return for invested capital. Smaller and poorer countries have their profitable State forests. They have borne the brunt of the experimental stage, and the British Government can now step into line and reap the benefit of others' experience. In connection with this article, the announcement, quoted above, of the appointment of an Irish Forestry Committee is of great importance.

Publication of Indian Departmental Literature.

The constitution of a Forest Research Institute, and the development of scientific investigation in the Forest Department, have shown the necessity of placing Indian Forest literature on a more satisfactory footing than heretofore, and the Government of India have sanctioned a proposal by which publications containing important information will remain available for permanent reference, and will be issued in a form both acceptable to the scientific world, and convenient for economic purposes. In future, therefore, the *Indian Forest Records* will be devoted to the publication of papers giving the results of the local investigations of the Research Institute staff, or of others, whether members of the Department or not; together with any short notes on pre-

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liminary research, the publication of which may be considered of advantage in aiding others to carry out further observations on the same subject. Notes and observations supplied by forest officers on such matters as the effects of exceptional seasons on forest growth, the seeding of the valuable species of trees, sudden attacks of serious pests, etc., will find a place in the *Records*. The *Records* will deal strictly with professional matters, and should form a valuable current exposition of the work of the Department, which will be of interest and utility alike to the members of the service and to scientists and those interested in forestry throughout the world.

The *Indian Forest Memoirs* will only appear when monographs suitable for reproduction in this form are received. They will be devoted to the publication of complete and important monographs on particular subjects. For example, memoirs dealing with careful research made into the silviculture of a particular species of tree, or with a family or genus of insect or fungus pests or the description of new species; researches into the formation, growth and economic uses of a particular gum, dye, tannin, etc. The *Memoirs* will be kept strictly technical, and will be open to the papers of all authors, having a scientific or economic bearing upon Indian forestry.

The pages of the above publications will be open to all who desire to secure for their researches a permanent place in Indian forest literature, whence it will be available to all those interested in the science of forestry.

The Albert or Hemlock Spruce at Loganbank.

By invitation of Mr A. W. Inglis, and in company with Dr A. W. Borthwick, I recently examined the Albert spruces at Loganbank, Midlothian, where trees about 40 years old have attained a height of 80 feet, or, in other words, show an average annual height-increment of about 2 feet. They have a very healthy appearance, and have by no means done growing. A group of these trees standing in an old stone-quarry have developed straight cylindrical stems, on which the dead side-branches persist after the manner of those of the silver fir and Norway spruce. The species can stand much shade, for we saw a bed of young plants which for the last four years have

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been, and still are, standing under the crown of a beech tree, and are further incommoded by a considerable amount of lateral shade; they were not developing rapidly, but had an otherwise healthy appearance. The young trees are found to suffer from frost, as do many other shade-bearing species, such as silver fir and beech. The tree grows well on wet soil, and suffered but little from the sulphur fumes which, a few years ago, caused great damage to the woods of Loganbank. We were shown a fence-stob, made from the timber of this species, which, its point having been dipped in coal-tar, had stood in the ground for twelve years. It was as sound as on the day the fence was set up, the sawn point still showing its clean-cut surface and edges. F. B.

Appointments by the Department of Woods.

The Deputy-Surveyorship of the Forest of Dean, vacant through the death of the late Mr Philip Baylis, has been filled by the appointment of Mr V. F. Leese, a qualified land agent.

We are authorised to state that Mr E. P. Popert, formerly of the Indian Forest Service, who has for some years past acted as assistant to Mr Baylis in the Forest of Dean, has been appointed Special Forestry Adviser to the Commissioners of Woods in respect of all the Crown Forests and Woodlands. He will arrange for the collection of data regarding their rate of development and other matters which form the basis of a rational management. He will personally superintend the working of the Forest of Dean and the Highmeadows Woods, keeping up the Control books and the records of the experimental plots, and submitting annually to the Commissioners, through the Deputy-Surveyor, a report on the work done in those woods, with proposals for their future management. He will also superintend the Government Forest School established in the Forest of Dean. The appointment of Mr Popert appears to secure adequate and long-needed professional control over the working of the Government forest estates.

Two Exceptional Trees.

On Newgate Bank, by the side of the road leading through Lord Feversham's splendid larch woods into Bilsdale, in the North Riding of Yorkshire, there stands a holly tree of uncom-

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mon size. The measurements of the bole are 2 feet long by 10 feet 8 inches circumference, and there are two limbs 3 feet by 7 feet 8 inches, and 4 feet by 6 feet 2 inches respectively. The tree has a large spreading top, and appears to be fairly healthy. Is not this a record size?

In Yarm-on-Tees, in the North Riding of Yorkshire, there may be seen a good specimen of the Californian Redwood (*Sequoia sempervirens*), trained as a wall-tree over the gable end of a building, and completely covering the whole wall from top to bottom. The total height is about 40 feet, and the tree is in a very healthy condition, and certainly has a splendid appearance. Do any of your readers know of a similar case?

W. B. HAVELOCK.

PLANTATIONS AT INVERLIEVER.

The following statement in regard to the timber crops now growing on the Inverliever estate have been supplied to us by Colonel Malcolm:—

NAME.	Position.	Date of Planting.	Acreage.
Torran, . .	East of farm buildings, between road to Inverliever and Loch Awe, . .	1894,	6 acres.
Island, . . .	South-west of the junction of the Liever with Loch Awe,	1877,	15½ acres.
Arichamish, .	North side of road at Inverliever boathouse, . . .	1877,	16 acres.
Ford, . . .	Above Gray's Holding, . .	No record,	9½ acres.
New York, .	West of Pier, ...	Supposed to be about 1863,	43½ acres.
		Total,	90½ acres.

POLTALLOCH ESTATE OFFICE,
27th November 1907.

ERRATUM.

Mr Fisher informs us that a somewhat important error occurs in his article on the Forest of Retz, in Vol. XVIII. (1905) of our *Transactions*, an error which he has only noticed recently. On p. 99, under the heading REVENUE, the first sentence should read, "The average annual yield of the whole forest from 1898 to 1900 was 2,684,430 cubic feet (solid), realising £24,61[illegible]," in place of "684,430 cubic feet" as in the text.

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OBITUARY.

Sir Dietrich Brandis, K.C.I.E., F.R.S.[1]

By the death of Sir Dietrich Brandis, which occurred at Bonn on 28th May, a man of world-wide renown has been removed. Brandis was born on 1st April 1824, at Bonn, being the son of Dr Christian Brandis, professor of philosophy in Bonn University. As a boy he followed his father to Greece, where he spent several years. On his return to Germany he was educated at the universities of Copenhagen, Göttingen, and Bonn. He became, in 1849, lecturer (*Privat-docent*) on Botany at Bonn. In 1854 he married a daughter of Dr Marshman, of Bengal. This happened to be the turning-point in his career.

After the occupation of the province of Pegu in Burma, Lord Dalhousie was looking for a man to take charge of the important teak forests of that province, when his attention was directed to Brandis by the latter's brother-in-law, General Sir Henry Havelock. Lord Dalhousie wrote to Brandis that if he would come to India he would be appointed superintendent of the Pegu teak forests. The offer was accepted, and Brandis landed at Calcutta in 1856. He explained his views to Lord Dalhousie, who, in taking leave of him, said: "Dr Brandis, if you carry out the scheme which you have explained to me, you will confer a great benefit upon this country." Brandis never saw Lord Dalhousie again, but his parting words remained with him throughout his service. Brandis set to work to save the Burma teak forests, in which endeavour he had the full support of Major (afterwards Sir Arthur) Phayre. After a long-continued struggle the forests were placed under systematic management, and they, with the forests of Upper Burma, are now the chief supply of teak timber to the world.

In 1862 Brandis was called to Simla, at the suggestion, it is believed, of Dr Cleghorn, one of the principal pioneers of forest conservancy in India, to advise the Government of India on forest matters in other provinces, and in 1864 he was appointed the first Inspector-General of Forests to the

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Government of India. He then set to work to introduce systematic forest management throughout India. A regular department was established and a forest law passed. Brandis travelled from one end of the Bengal Presidency to the other, advising and organising the department. He also visited Bombay twice, and spent two years (1881-83) in Madras. The department thus created has grown until it has now under its management an area of 239,000 square miles, equal to twice the area of Great Britain and Ireland.

When Brandis first started operations he had to do with what staff he could lay his hands on; but he determined to obtain one fit to deal with the requirements of the case. In 1866, while on sick leave in England, he obtained the sanction of the late Lord Salisbury, then Secretary of State for India, to train young Englishmen in Continental forest schools, and under this scheme a number of highly-qualified foresters have been sent to India. The training at Continental forest schools was subsequently supplanted by that at Coopers Hill College, and now at the University of Oxford.

But Brandis went a step further. In 1878 he started a forest school at Dehra Dun for the training of natives of India, which has now been raised to the rank of "The Imperial Indian Forest College," and sends annually from forty to fifty trained executive officers into the service.

By these means a trained staff of 200 Englishmen have been obtained, who control the operations of the Forest Department, assisted by about 11,000 native officials of various grades. The results are most gratifying. The supply of timber, firewood, grass, and other produce from the teeming millions of India has been placed on a satisfactory footing, while the net revenue from the forests has risen from £40,000 in 1864 to £660,000 in 1904, although produce valued at a similar sum is given free to the people of the country.

During his career in India Brandis wrote an endless number of reports, and in 1874 he brought out the *Forest Flora of North-west and Central India*, a work which was so highly thought of by Sir Joseph Hooker and others, that he was made a Fellow of the Royal Society in 1875. It may not be generally known that Brandis was the first who compiled a rainfall map of India; it has been improved since, but as regards the main points it holds good to this day.

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Brandis retired from the Indian service in 1883, at the age of fifty-nine years; but he continued to devote himself to the advancement of forest conservancy in India, by articles and letters of advice to his friends in India. From 1888 to 1896 he superintended the practical instruction in Germany of the Coopers Hill forest students.

The last eight years of his life he devoted to the writing of a general Indian forest flora, which he published in 1906 under the title of *Indian Trees*, a monumental work which is likely to be the standing book of reference on the subject for another generation. Scarcely had he completed this when he fell ill, and he never rose from his sick-bed. He was made a C.I.E. in 1876 and a K.C.I.E. in 1887.

It should not be omitted to mention that Brandis had a great share in the development of forest conservancy in the United States. He guided the studies of quite a number of young Americans, who have since established a great department in the United States. His influence in this respect has been so great that President Roosevelt presented him with his picture and the following dedication:—"To Sir Dietrich Brandis in high appreciation of his services to forestry in the United States, from Theodore Roosevelt."

Apart from India and the United States, Brandis's action has been felt in almost all parts of the British Empire, including these islands. He has left his mark upon every continent of the earth; at any rate, his name will go to posterity as the father of systematic forest management in the British Empire.

W. SCHLICH.

M. LUCIEN BOPPE, C.I.E.[1]

On the 21st of last May, the *Ecole Nationale des Eaux et Forêts* lost its Honorary Director, M. Lucien Boppe, who had been Professor there since 1881, and Director from 1893 to 1898. Born at Nancy on 3rd July 1834, first *Garde Générale* at St Dié and at Vézelize, *Sous-Inspecteur* first at Moutiers and then in the Department of Meuse, M. Boppe was called in 1868 to Nancy as *Sous-Inspecteur*, to take part in the administration of the forest attached to the School of Forestry. Retained in this

[1] Translated from the French.

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position after his nomination to the grade of *Inspecteur* in 1878, he acquired a most perfect knowledge of French broad-leaved forests, and was a past master in the conduct of those delicate operations which concern the conversion of coppice-with-standards into high forest. Nevertheless, being a born forester, M. Boppe fully appreciated the fact that the forests of the east of France are not the only existing type, and that such conversions are not the whole of forestry. In consequence, when, in 1881, he was appointed to a professorship in Forestal Sciences at the National School, before beginning to teach, he undertook a tour through the forest regions of France. During this tour he took cognisance of all the varied types of French forests, and studied on the ground the methods of treatment and of exploitation, the utilisation of the wood and of the accessory products. It is to his studies during this long tour that we owe the publication of the two most remarkable works of M. Boppe, his *Cours de Technologie Forestière* (1886), a book which was originally written by M. Nanquette, but to which M. Boppe added some valuable information, previously unpublished, on methods of conversion and utilisation of forest products; and his *Traité de Sylviculture* (1889). In this book, after setting forth in the clearest and most instructive manner the French methods of treatment, he strove to render justice to other methods which up to this time had been perhaps too much disregarded, such as selection fellings in beech coppice, and similar practices, justified by local conditions, and only requiring a little regulation to be rendered quite acceptable by French foresters.

His desire to study forest conditions on the spot, and to obtain first-hand information from those actually in charge, in the most diverse localities, led M. Boppe often beyond the confines of France. Of these tours he has left us some interesting narratives. I always re-read, with the greatest pleasure, his papers on—*Les Forêts de la Grande Bretagne* (1881); *La Forêt de Spessart* (1881, in collaboration with M. Reuss); *L'Enseignement Forestière en Bavière et en Autriche Hongrie* (1886, in collaboration with M. Reuss); *L'Organisation Forestière en Bavière et en Autriche* (1887, in collaboration with M. Reuss).

In 1900 I had the honour of collaborating with M. Boppe in the publication of his silvicultural treatise *Les Forêts* (1900). Soon after, unfortunately, his health gave cause for anxiety—

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anxiety which was, alas! only too well justified—and this summer we had the grief of seeing our loved and honoured chief pass away. In him we lost a forester as devoted to his subject as he was learned and experienced. A. JOLYET.

The writer of the above notice succeeded the late M. Boppe as Professor of Silviculture in the National Forest School at Nancy.

M. Boppe was *Sous-Directeur* of the school when I was in charge of the British students there, from 1884 until the India Office in 1886 ceased to train its men at Nancy. His high professional attainments, and his kindly, courteous manner, secured for him the respectful affection of our young countrymen. At this time I formed with him an intimate friendship, which was maintained until the day of his lamented death. It was my almost daily privilege to accompany him to his room after the delivery of his lecture, and there, greatly to my advantage, to discuss with him the subjects he had just treated of during his address to his class. In recognition of his eminent services in connection with the training of candidates for the Indian Forest Service, M. Boppe was made a Companion of the Indian Empire, a distinction which he prized very highly. F. B.

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REVIEWS.

Forest Mensuration. By H. S. GRAVES, M.A. New York, John Wiley & Sons; London, Chapman & Hall, Ltd., 1906.

In the Preface Mr Graves tells us that the urgent need of a reference book on Forest Mensuration for class work at the Yale Forest School induced him to publish his lectures given during the last year, with such additions as were necessary to present the material in the form of a book. The work contains 436 pages, which is a very liberal allowance for one of the many branches of forest science. To give our readers an idea of the scope of the book, we give a short account of the contents:—

Chapter I. gives a definition of Forest Mensuration, and discusses the importance of its study, the Literature of the Subject, and the Units of Measurement.

Chapters II. and III. deal with Board Measure and Log Rules. What Mr Graves tells us of board measure and log rules proves that the system of measurement as yet followed in the United States is hardly in accordance with the general development of the country. There are some 43 different log rules, which lead to widely different results. Taking, for instance, the example on pages 24, 25, we find that the board measure for a log 16 feet long is given for diameters ranging from 6 to 40 inches, according to 43 different log rules. For a diameter of 30 inches, the board measure of the same log ranges from 942 feet down to 427 feet, according to the method followed. No wonder the author says (page 15): "One is inclined to advocate the abolishment of the board foot as a unit of measuring round logs."

Chapter IV. is devoted to Log Rules based on Standards. A standard log of specified dimensions is used as a unit of volume. For instance (page 54), the unit is a log 13 feet long and 19 inches in diameter at the small end inside the bark. Other logs are compared with this, according to their diameter at the small end and their length; thus a 10 inch log, 13 feet long, contains 0·28 standards. Standard measure is commonly converted into broad measure by multiplying the volume of a given log in standards by a constant. Mr Graves then shows that this is not correct. There are a number of other log rules

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with different standards. It is hardly possible to imagine a more barbarous method. Why not take the ton (or 50 cubic feet), or simply the cubic foot, as the standard measure?

Chapter V. deals with the Methods of Scaling Logs; that is to say, the instruments for scaling, methods of measuring the diameters and lengths, allowance for defects, and the rules for scaling used in Forest Reserves.

Chapter VI. brings us at last to the Determination of the Contents of Logs in Cubic Feet. We were glad to be informed that the cubic foot is already used extensively in the United States, but even then the volume is finally expressed in board feet or other units common in commerce. What use the cubic foot is, under these circumstances, is difficult to see. The chapter goes into the minutest details of the case, showing how logs should be measured, the instruments used, formulæ for determining the cubic contents in quite a variety of ways, including the full volume in the round, the quarter-girth method, and others.

Chapter VII. deals with the Cubic Contents of Squared Logs.

Chapter VIII. brings the Measurement of Cord Wood, Stacked, and the Solid Contents in a Stacked Cord.

Chapter IX. deals with the Contents of Entire Felled Trees, or a combination of what has gone before.

Chapter X. deals with the Determination of the Height of Standing Trees. Here we leave American soil, and go for a promenade to Germany, France, England, Austria, and Switzerland. The instruments dealt with in detail are those of Faustmann, Weise, Christen, Klausner, Winckler, Brandis, Gaulier, Abney and others. All these have been described in various European books. When we come to the "choice" of a height-measure, we were not a little surprised to find that Mr Graves considers Klausner's height-measurer the best of the small instruments for accurate scientific work, and Faustmann's measurer for general forest work. When it is considered that Klausner's instrument either necessitates a stand or must be screwed into a tree, and that, moreover, the clumsy sighting rule is quite unnecessary (since the ray from the eye is much straighter than a metal rule), we can only come to the conclusion that Mr Graves cannot have used the instrument in the field on an extensive scale. As to Faustmann's measurer, its theory is perfect, but the instrument is very delicate for work in the forest, and we certainly prefer Weise's instrument

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to it. On the general question, we have no hesitation in saying that Brandis's instrument is the most useful all round, and Christen's for trees not exceeding 100 feet in height.

Chapters XI., XII., and XIII. deal with the Determination of the Contents of Standing Trees, by the eye, Volume Tables, Farm Factors, etc. Here we are still chiefly on European ground.

Chapter XIV. treats of the Determination of the Contents of Stands or Whole Woods. It is a combination of German methods with American practice. There is the estimate by the eye "en bloc," or by tree; by Stand Tables and by Valuation Surveys (that is to say, the measurement of sample plots, which may take the shape of a strip or other form). Then comes the measurement of the trees; the recording; the methods by felled sample trees, such as the mean sample-tree method, the arbitrary Group method, Draudt's, Urich's and Hartig's methods, the method of form factors, and others, as described in European forest literature.

Chapter XV. brings the Determination of the Age of Trees and Stands in the well-known orthodox style.

Chapter XVI. deals at considerable detail with the Growth of Trees and Stands, that is to say, with the Diameter, Height, and Volume Increment.

Chapter XVII. is devoted to Yield-Tables, which is followed by a final chapter on Graphic Methods used in Forest Mensuration.

The Appendix deals with Legislation regarding the Measurement of Logs in the United States; a list of the most important works dealing with Forest Mensuration; tables showing the Contents of Logs; volume tables for standing trees, and tables for form factors; tables of growth and yield of spruce, beech, and Scots pine in Germany; again, yield-tables of American trees, such as white (or Weymouth) pine, Adirondack spruce, loblolly pine, chestnut, red cedar, red oak, and pitch pine, and miscellaneous tables.

It will be observed that the book is very complete, but it is also very big, and it contains a good many things which will hardly be of use in the United States for some time to come. Still, the book contains, in addition to the German methods of forest mensuration, original ideas, and we have no doubt that it will mark another step in advance in the development of scientific and systematic forestry in the United States.

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Schlich's *Manual of Forestry*. Vol. IV., "Forest Protection," 2nd ed., by W. R. FISHER.

xxiii. + 712 pp. Bradbury, Agnew, & Co., London. 12s. net.

In the new edition, the number of pages has been increased by 119, which include an Index not found in the first edition. The number of plates has also been increased from 259 to 300. The author says in the Preface that he had been urged to write an original book on "Forest Protection," but that it would have been impossible for him to do so without borrowing largely from German authors, and that it therefore appeared preferable to continue his former plan of translating the best German work on the subject,—that by Dr Hess. The present volume is not, however, merely a translation of that book; Professor Fisher has added matter that he considered important for British and Indian foresters, and has omitted other matter as being of comparatively small interest to them.

We may remind our readers that this work deals with injuries to forests done by man, quadrupeds, birds, insects, weeds, fungi, atmospheric influences (such as frost, wind, snow, etc.), fire, flood, and shifting sand; also against certain diseases and the effects of acid fumes from furnaces.

It is very complete, and should be in the hands of all working foresters and others interested in wood management.

Quarterly Journal of Forestry published for the Royal English Arboricultural Society. Vol. I. No. 4.

The October number of the above *Journal* maintains the high standard of excellence of former issues. It is made up of current topics and short notes on various subjects connected with forestry, obituary notices, two original articles, three reprints, and a number of reviews and notices of books. A report of the Afforestation Conference held in London on 25th June completes the number.

The original article, on the "Variation of *Salix alba*," by E. R. Pratt, is a well worked out and beautifully illustrated paper, which deals with a very difficult subject.

The current topics and short notes are very well chosen, and certainly cannot fail to keep the members posted up in the forestry happenings of the day, while the carefully written reviews and notices of books keep one in touch with the current literature.

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

18. Trees of Western America.[1]

By F. R. S. BALFOUR.

My wife and I have recently made a trip to the Pacific coast, and perhaps our chief object in so doing was to see the trees of that region, the richest belt of coniferous timber in the world.

I have twice lived for eighteen months at a time in Washington, Oregon, and California, and have made a good many shooting and fishing expeditions into the western mountains, but never before has my sole object in such expeditions been to see the best of the timber. I hope to have something to say of our wanderings which will be of interest to those Members of the Royal Scottish Arboricultural Society who are here to-day; but I wish it to be understood that I can merely tell you of the observations of a lover of trees, who has little intimate knowledge of botany.

We sailed in July to Quebec, and crossed the continent by the C.P.R. We stayed for a few days at the Lake Louise Hotel at Laggan in the Rockies, about 6000 feet above sea-level, and 960 miles west of Winnipeg. The hotel lies at the north end of Lake Louise, six miles from the railway, and 1000 feet above it. Soon after leaving Calgary, the youngest and one of the most prosperous towns on the continent, the train begins to wind its way up the Bow River, with the towering Rockies to the north and south. The first tree we have seen for over a thousand miles is the ubiquitous *Pinus contorta*, springing up thick and straight in all directions. No tree in America covers such an area—from Alaska to Colorado. It is well called the lodge pole pine by the Indians.

[1] Lecture delivered, with lantern slides, to the Royal Scottish Arboricultural Society at their Annual Meeting, 5th February 1908.

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It was a mild rainy day when we arrived, and after reaching the hotel it did not take me many minutes to recognise, with my glasses, the light green of the Lyall larch, growing at timber-level—7000 to 8000 feet. I started through the thick undergrowth of azalea and blaeberry, and was soon thoroughly drenched. The *Pinus contorta* had been left behind before Lake Louise was reached, and the timber here is *Picea Engelmanni* and *Abies lasiocarpa* solely. Both were covered with cones—even trees only 6 feet high—and indeed the two are much alike, but for the red drooping cones of the *Picea* and the black erect ones of the *Abies*. After a good deal stiffer climb than I expected, I reached the first of the *Larix Lyallii*, and managed to get some photographs taken while the rain was falling. The tree was first discovered by David Lyall, a Scotsman who accompanied the expedition which settled the International Boundary in 1857. It never exceeds 85 feet in height, and 2 to 3 feet in diameter. The woolly tomentum which covers the twigs and buds makes it easily recognisable. As far as I am aware, it has never before been brought to this country, but I arranged with a Chinaman to get me later on a supply of the seed and about a dozen plants which I have growing at Dawyck. The seeds ripen and are shed in the first three weeks of September; they do not remain in the cones as with our larch. I hope I may raise some plants and keep those I have got. This larch is so purely Alpine in its habit, that I have no expectation that it would ever be a useful tree in this country. Its great kinsman, *Larix occidentalis*, however, is perhaps better worth growing as a timber-tree in Great Britain than any other exotic. This tree, which unfortunately did not seed last season, does not grow so high up or extend so far north as *Lyallii*, and covers a much wider area throughout Eastern Oregon and Washington, parts of Montana and Idaho, and the Kootenay County of British Columbia. A splendid tree, it often grows to 200 feet high; the largest specimen I know of is 24 feet round, 6 feet from the ground; this tree is in the Wallowa Mountains of Oregon. This larch is incomparably the grandest variety of larch in the world. Throughout this country there is a thick undergrowth of azalea covered with lemon coloured blossom, not the azalea of the West, but one with small waxy bell-like flowers. We made an expedition on horseback to the glacier which discharges into the south end of

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the lake, and also to two small lakes a thousand feet higher up than the hotel, where we left the timber-line behind, and found Lyall's larch growing pure. The trees of this region have their branches very short from base to top, owing to the immense weight of snow and ice which covers them for so much of the year.

I shall say little of our journey from the Rockies, across the Selkirks and Coast Mountains, to the Fraser River Cañon. Suffice to say that four miles west of Laggan the line crosses the continental divide through the Kicking-horse Pass, and almost at once the timber begins to grow western in its character. Douglas fir and *Thuja gigantea* are seen for the first time as we drop down into the valley of the Upper Columbia River. Then when we have crossed the river and begin to climb up the precipitous Beaver Cañon of the Selkirks, we see splendid *Tsuga Albertiana*, *Pinus monticola*, *Picea Engelmanni* and *Pinus contorta* giving way gradually to *Thuja gigantea* and Douglas. The day's run from Laggan to Revelstoke is through as splendid mountain scenery as exists anywhere; doubtless many here have made that journey, and stayed in the delightful hotels provided by the C.P.R.

In the lower Fraser River valley grows that finest of all birches—*Betula occidentalis*,—a tree practically unknown here, though there is no reason why it should not thrive in our climate, so like its own of British Columbia.

Our objective point was Tacoma, in the State of Washington, on Puget Sound. In the valleys of Northern Washington through which our line—the Northern Pacific—ran, we saw Douglas and *Thuja gigantea* growing as only they *do* grow on the mild sea-board of the North Pacific. Terrible burnt areas too we passed, where not a seedling was to be seen, and only bracken and willow-herb springing up among the blackened stumps. Happily this destruction by fire has been reduced about 85 per cent. during the past season, owing to the excellent arrangements, regulations, and active supervision of the officers of the United States Timber Reservations. We saw large specimens of the greatest of American maples (*Acer macrophyllum*) growing among the tangles of the vine maple (*Acer circinnatum*) in all the river bottoms. Here and there was an occasional *Picea Menziesii*—it never occurs over thirty miles from the sea, and we were now well within that distance of Puget Sound.

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The luxuriance of all this western timber, its size, the freedom with which it seeds itself, and its rapidity of growth, render these forests quite unlike anything to be seen east of the Coast Mountains. It is the land, too, of flowering and berried shrubs, *Spirea*, *Berberris* of several kinds (including our well-known *B. aquifolium*), *Ribes*, numerous *Rubus*, *Gaultheria shalon*, sometimes a tree 20 feet high—the Sal-lal of the Indians,—that most striking of arbuti, the Madroña tree, the lovely western dogwood (*Cornus nuttallii*), two beautiful elders, one red and one blue-berried (*Sambucus arborescens* and *S. glauca*), several *Rhamnus*, and five great blaeberries or *Vaccinium*, some red and some blue-berried, but all, as a rule, 6 feet high.

There is a range of mountains still almost entirely unexplored, occupying the triangle of land which forms the portion of the State of Washington that overlaps the south end of Vancouver Island. A couple of days after reaching Tacoma, we set out for these Olympic Mountains, crossing Puget Sound, and driving for two days over nearly impossible roads through as fine Douglas and *Albertiana* forest as I have ever seen. The summer climate of those parts is quite delightful, never too warm, with cloudless skies and only occasional showery days. Our first resting-place was the little log hotel on Lake Cushman, surrounded by Douglas fir and *Thuja gigantea*. Seven years ago I made a small expedition after black bears across the mountains at the head of this lake, and then found at snow-level whole gardens of lovely flowers, *Fritillaria*, *Brodiæa*, *Calochortus*, orchids, and, most charming of all, the beautiful *Calypso borealis*, but that was in June. The river which feeds the lake, for a couple of miles of its course, flows through alluvial land well sheltered by the surrounding mountains from the winds of the Pacific, and here we found a grove of extraordinarily tall *Acer macrophyllum*, intermingled with *Populus tricocarpa*, *Alnus Oregona*, and *Thuja gigantea*. Their branches are thickly clothed with dense growth of yellow moss and ferns: the height of the trees I judged to be rather over 150 feet. The poplar of this region commonly grows to nearly 200 feet, and is the largest deciduous tree west of the Rockies—or, I believe, on the continent—and this great maple is second to it. I here, too, saw the largest *Thuja gigantea* I ever came across; it measured just 40 feet round, breast high, and was about 300 feet high. This is, however, by no means the record. Throughout the valleys

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of this range the Douglas fir must average about 250 feet, and the *Tsuga* little short of it. I stepped the trees in this photograph, and found they measured 210 feet before the first branch was reached. A guide whom I had taken with me when last in these mountains told us that a party of prospectors had cut a trail up the South Fork of the Skokomish River (the North Fork was the river flowing out of Lake Cushman, up which we had come). We determined to follow this trail for a few days' fishing and exploring. We were well repaid. The first day out, with four horses and our two men, we reached the river, and camped in a clump of aspen poplars (*Populus tremuloides*), sleeping on beds of *Thuja gigantea* boughs. Most of our day's march was through dense *Albertiana* spruce, and we noticed how wonderfully this tree seeds itself, more especially on the soft bark of a rotten fallen tree-trunk. Attempts at photographing it, however, were not very successful. We found *Pinus monticola* growing on the ridge between the North Fork and the South Fork. Next day we continued our way, and made our camp for three days on a little plateau in a bend of the river in a grove of *Abies grandis*, our tent shaded by the branches of *Rhamnus purshiana*—the tree from which the cascara sagrada bark is got. It was covered with ripe black fruit, of which I dried a portion, and am sowing it in the hope of establishing the tree here. The Rainbow trout fishing was too excellent to be neglected, even for trees, as I think you will agree when I tell you that in my last four hours fishing on that stream I caught 53 trout, weighing just 60 lbs. My wife landed a 4½ pounder off her second cast. To picture this country, you must realise that the whole land is dense forest, with open spaces nowhere except where the peaks of the hills struggle through in rocky pinnacles. Our trail was for the most part along the river-bed, which we crossed and re-crossed countless times. As in all the densely wooded regions of the North-West, one sees few birds and beasts. An occasional black-tailed deer, a still more occasional black bear, and a frequent mink in the river bottoms, were all we saw. Of birds there are a few small warblers, several woodpeckers, and a beautiful great grey kingfisher, this last to be seen everywhere.

We returned to Tacoma, and my next expedition was to the Nisqually Glacier, which flows down the south-west side of the great Mount Tacoma—15,000 feet. The United States Govern-

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ment have made a national park of 3,000,000 acres, with this splendid cone in the middle, and no better or wiser thing has the American administration ever done than to establish the great timber reserves—and also the five National Parks, in the most interesting localities: these are the "Yellowstone" of Wyoming, the "Yosemite" and "Sequoia Forest" of California, the Grand Cañon of Arizona, and this "Rainier National Park" of Washington, to be inviolate for all time. I may here digress for a moment to say a little on this subject. Until recently, the timber, in the West at any rate, was regarded as quite inexhaustible, and only in the last few years have the people awakened to the fact that unless a great part of the remaining forest were preserved, there would soon be no more. The total lumber cut in the United States in 1906 was about 40 billion feet, board measurement. It is estimated that the West has about sixty years of timber for itself—over 70 per cent. of which is "Oregon pine," or rather Douglas—but the East, whose own supply will probably last for not more than twenty years, is drawing on the West for prodigious quantities of sawn timber. Washington is now the State which supplies the greatest amount of timber of any. From 1870 to 1890 Wisconsin, with its white pine (*P. strobus*), had the predominance, then Louisiana, where *Pinus palustris* is cut in enormous quantities (the Americans call it "yellow pine" and we call it "pitch pine"[1]), but now Douglas fir provides more lumber than any other tree on the continent. The U.S. Government Timber Reserves now amount to 126 million of acres, by far the larger part of which is in the west. These are being well looked after when we consider the magnitude of the task, the supineness of the State legislatures, the opposition of the lumber magnates, and the fact that the whole organisation has only recently been started.

A little light railway through the Douglas and *Thuja* takes one to within a few miles of the boundary of the Mount Tacoma Government Reserve, and a drive of a dozen miles or more of

[1] The following extracts are taken from Bulletin No. 10, U.S. Department of Agriculture, Division of Forestry, 1895:—"Yellow pine" is applied in the trade to all the Southern lumber pines; in the North-east it is also applied to the pitch pine (*P. rigida*); in the West it refers mostly to bull pine (*P. ponderosa*). "Pitch pine" includes all Southern pines, and also the true pitch pine (*P. rigida*), but it is mostly applied, especially in foreign markets, to the wood of the long-leaved pine (*P. palustris*).—HON. ED.

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steep climbing brings one to the hotel recently built at Longmires Springs. The Government carriage road is completed to a little beyond this point, but the intention is that it shall be continued to Paradise Valley—9000 feet above the sea—which is at timber-line. The spot is well named, as, perhaps, there is no finer Alpine garden in the world than this huge belt immediately above the trees, and below the eternal ice of the mighty cone of Mount Tacoma. The trees here are very fine, *Thuja*, Douglas fir, and *Tsuga Albertiana*, *Abies grandis* in the river-bed, and an occasional *Menziesii*, till the eastern limit of this tree was passed. Then *Abies amabilis*, *Pinus monticola*, *Pinus Murrayana*, and at Longmires *Abies lasiocarpa*, *Tsuga Pattoniana*, and *Chamæcyparis nootkatensis* (*Thujopsis borealis*). I never before saw this tree, and feel sure it is worthy of general planting in our country as a forest-tree. It covers a wide area from Alaska to Washington. The specimens in this country have mostly been raised from cuttings, and I believe it would be desirable to get large supplies of seed from its native place. Its wood is practically imperishable, but is no use for shingles, as it cannot be split like *Thuja* or *Libocedrus*. I went on to the Nisqually glacier, to which the Government road has just reached. The difficulties of blasting out stumps and rocks for such a road may be imagined. I found here the charming little *Acer glabrum*, which only grows at high altitudes in the western country. I know of no other valley in Western America where such a variety of conifers may be seen growing together, and all at their best—2 hemlocks, 4 *Abies*, 2 pines, 1 *Picea*, 1 *Thuja*, 1 cypress, the omnipresent Douglas—12 altogether.

We next travelled south to Grant's Pass in South-West Oregon. Unfortunately our day in Portland was cloudy, and no view could be had of Mount Hood, the great rival of Mounts Tacoma and Shasta. The Siskiyou Mountains, which run east and west more or less, divide Oregon and California, and this is the home of that rarest of all spruces, *Picea Breweriana*. The character of the soil is greatly changed here from that of the north. The ground is dry, and there is not the great depth of rich humus in all the valleys which one sees in Washington. We drove thirty miles to the old mining settlement of Kerby, and next day started over an impossible road to find our spruce. A friendly placer-miner acted as guide, and after a climb of 4000 feet through almost impenetrable and what seemed interminable thickets, we found

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our tree just at timber-line, growing singly among Douglas fir, *Pinus ponderosa*, and *Pinus tuberculata* (the knob-cone pine). It is a beautiful tree, utterly distinct in character, with drooping branchlets often 8 feet long. The tops of the trees were covered with cones a good month from being ripe. The tree was first discovered in 1884, and named after an eminent Californian botanist. Its cones, when the seed is shed, reflex their scales, and are of a rich brown. The unripe cones are purple, about 2½ inches long. I imagine the wood of the tree is extremely hard, growing as it does at a fairly high altitude, and evidently making small annual growth. The bark is grey, and in flakes not unlike that of our larch. The trees of this district are very different from what we had left: *Pinus ponderosa* and *Pinus Lambertiana*—those two kings among pine trees—predominated. *Thuja gigantea* had given way to *Libocedrus decurrens*, and in the valleys grew the *Umbellularia Californica*—a mighty bay which occasionally reaches 100 feet; the *Castanopsis chrysophyllum*, with its shining leaves, bright yellow underneath, and chestnut-like fruit; and the *Pasania*, or tan-bark oak. The *Fraxinus Oregona* I saw here finer than elsewhere; it is an ash which I hope may succeed admirably in our own country, judging by the fine young tree at Kew. It is the most valuable hardwood in the west. I have distributed the seed of this tree to sixteen or more localities in Great Britain. I saw the *Chamæcyparis Lawsoniana* that day—3rd September—for the first time; but to see this splendid tree at its best we ought to have gone west a farther fifty miles to the coast. No tree in Western America is more prized than this "Port Orford Cedar," as the lumbermen call it. Its wood is almost imperishable, and its delicious scent makes it highly suitable for interior finishing, etc.

A stranger in the country has a little difficulty in identifying trees by their local names. For instance, I was told I ought to see the "larch" on Mount Tacoma. This I found was *Abies nobilis*. "Red cedar" in British Columbia and Washington means *Thuja gigantea*; "red cedar" in South Oregon and California means *Libocedrus decurrens*. "White cedar" in Washington means *Cupressus nootkatensis*; "white cedar" in Oregon means *Cupressus Lawsoniana*. But, worst of all, the name "Tamarack" is applied in different neighbourhoods to *Larix occidentalis*, *Pinus tuberculata* and *Pinus Murrayana*. This confusion of nomenclature also extends in America to the birds and beasts.

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We made a four days' camping expedition from Kerby southwards to the main ridge of the mountains, crossing the Californian boundary. It is a beautiful country-side. There are several fine oak trees—*Quercus densiflora* or *pasania*, mentioned above, *Quercus Wizlizeni*, and *Quercus Garryana*—said to grow to 150 feet high, and nearly a dozen species of willow; quantities of gentians occur in the marshy spots, with the yellow pitcher plant (*Darlingtonia Californica*). We found groves of *Prunus demissa* with the fruit ripe and hanging in bunches—a charming tree. The hill-sides are clothed with *Manzanita* and *Ceanothus* bushes. Our guide was anxious to take us to what he believed to be the "weeping spruce" we were in search of; but after a hard day's toil up steep hills, over trails which none but a backwoodsman would differentiate from the surrounding brush, we found ourselves among a number of Douglas fir, whose branches, growing in a curious bunchy form, had misled our man. However, the scenery well repaid the extra labour. That night we camped close to the divide, and next day, while hunting the hill-tops for black-tail deer, I came quite unexpectedly on a splendid grove of *Picea Breweriana* in a corry facing north. I took numerous photographs of the trees; they were growing among *Abies concolor*, *Abies magnifica*, *Libocedrus*, and Douglas. I saw no cones on these trees. They stood distinct and beautiful, with their long fronds often hanging 8 feet to the ground. On this ridge the *Libocedrus* and Douglas were gnarled and twisted by the wind into the most fantastic shapes. We returned to Kerby and Grant's Pass highly satisfied with our week's trip, and pleased to have found what we had gone so far in search of.

We took train from Grant's Pass, by night unfortunately, as we were limited as to time, and next morning found ourselves at Sisson, at the base of Mount Shasta in North California. Here a small branch line leaves the Southern Pacific, and proceeds due east to a timber settlement called M'Cloud, after its founder —doubtless a Skyeman. Six miles from here is the charming house of a friend of mine, on the edge of the great Shasta Timber Reserve, in a bend of the M'Cloud River. Its banks are clothed with a huge saxifrage, among which the vine maple leaves were just turning scarlet. The timber is Douglas and *Abies concolor* close beside the river; higher up *Pinus ponderosa* and *Pinus Lambertiana*, growing finer than any I have seen elsewhere in California; while still higher are *Pinus monticola* and *Abies*

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magnifica—the *Shastanensis* variety, which has dark bark instead of red, as in the common form; and last of all *Pinus albicaulis*, sometimes dwarfed to a tree 2 or 3 feet high, although a hundred years old. The photographs of Mount Shasta—14,400 feet—will show you how that splendid cone overlooks the whole country for at least one hundred miles in every direction. Down by the M'Cloud *Taxus brevifolia* is abundant, never such a large yew, however, as our *T. baccata*, but very beautiful, with its red berries and dark branches sheltering the lovely Shasta and Humboldt lilies, which grow tall and straight in the moist glades where the sun seldom penetrates. I found here, for the first time, *Cratægus Douglasii*, the only hawthorn which grows in the western country, although 400 or 500 species are known east of the Rockies. I also saw a small mountain ash which I could not identify. The brushwood is wild plum (*Prunus subcordata*), at this time covered with fruit, much sought after by the Indians, the Californian hazel (*Corylus Californica*)—to me quite indistinguishable from our own, and, of course, the universal manzanita scrub and alder. While we rode with our host to "salt-licks," where the deer were to be found in the early mornings, we got many lovely glimpses of Mount Shasta towering above the surrounding forests. We scrambled up banks of incredibly slippery pine needles to gather the huge cones of the sugar pines, many of them 20 inches long: these we brought home in sacks tied to our Mexican saddles. Our host every year has new trails cut through the brush, and this summer came on two enormous specimens of sugar pine and yellow pine. My photograph of the latter was a failure, but you will see to what a gigantic size *Pinus Lambertiana* sometimes grows. The summer climate of this Northern California country is well-nigh perfect, six months of unbroken sunshine.

I have a set of interesting photographs of "lumbering" in the yellow pine forests of this country which may be of interest.

Of our other expeditions far south into the Sierra Nevada and Coast Range Mountains, and of the *Sequoias* and other trees we saw, there is no time to speak now.

I fear that my paper is little else than a list of trees seen by us on our wanderings, but I hope my photographs may make up to some extent for its other deficiencies.

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19. Soil: its Origin and Nature.

By Professor JAMES GEIKIE, LL.D., D.C.L., F.R.S.

(*Concluded from p.* 21.)

III.

(*b*) DRIFT SOILS.

These are soils which do not arise from the disintegration of immediately underlying bed-rock, but are simply the modified upper portions of superficial formations of every kind. The materials of which they are composed have been transported for shorter or longer distances.

GLACIAL SOILS.—These soils overlie superficial accumulations of glacial origin—the more typical of which are certain kinds of clay.

Till or Boulder-Clay.—This clay is usually tough and tenacious, more or less highly impermeable, and abundantly crowded with stones and boulders of all shapes and sizes. From an agricultural point of view its most notable character is not so much its impermeability as its composition. It consists almost exclusively of "unweathered" rock-material—its mineral constituents are quite unaltered, and it is, therefore, in no sense of the term a "subsoil." It plays the part, in fact, of unweathered bed-rock. It appears to have originated under the great ice-sheet which formerly covered our country, and which, flowing off in various directions, crushed, ground, and pulverised the underlying bed-rocks. Its formation, therefore, was entirely mechanical—the chemical action of the atmosphere and rain being excluded. The "clay" consists, to a very large extent, of a fine rock-meal or flour, which, although it may contain all the elements met with in ordinary fertile soils, is nevertheless barren, since the constituent mineral matter is not in a fit condition to be assimilated by plants. Owing to the general impermeable character of boulder-clay, a soil-cap forms very slowly upon it. But all tills are not alike in this respect. In some parts of the country, where till consists largely of crushed sandstone, it is somewhat more permeable, and yields a thicker soil-cap, the upper part of which, a foot or less in thickness, forms a strong loam or loamy clay-soil. Not only the composition but the colour of the till varies. This is readily

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understood when it is remembered that till consists simply of crushed bed-rock, and that its character must change with that of the bed-rock of a district. Thus, in regions occupied by Old Red Sandstone, the till is red and more or less arenaceous, and not infrequently yields a fertile soil. Where, on the other hand, the dominant rocks are white and grey sandstones, and black argillaceous shales, together with fire-clay, coals, iron-stones, and limestones, the till is greyish-blue or leaden-coloured, and usually very tenacious—yielding a most ungrateful soil. In some places, again, the till contains a large admixture of crushed basalt or other igneous rock, and, when not too impermeable, such a till is overlaid with soil of good quality. Chalky boulder-clay, composed chiefly of pulverised chalk, yields a clay-soil, from which, in most cases, the calcareous constituents have been in large measure removed. Upon the whole, the best soils met with in districts covered with till are brown and red-coloured—forming, as these frequently do, strong loams rather than clays.

Stoneless Clays.—These clays are also of glacial origin, but have been accumulated in water. Most of them were laid down in the sea at a time when the land was partially submerged, and they are therefore confined to low-lying maritime districts. Good examples are met with in the lower reaches of the great valleys of Central Scotland, where they form a considerable proportion of the carse-lands of the Tay, the Forth, and the Clyde. In composition these clays do not differ from true till. Like the till, they consist of unweathered rock-material. They represent the fine mud, etc., swept into our estuaries by turbid rivers escaping from glaciers, too short a time having elapsed before they settled down on the sea-floor to allow of much chemical alteration. Except when they alternate in thin layers with beds of sand, they naturally form exceedingly tenacious clay-soils. When interbedded sand is present, the resulting soil is less ungrateful.

In the case of both the stony and stoneless clays of glacial origin, it is obvious that deep ploughing ought to be avoided. The soil-caps covering both are alike thin, and have taken a long time to form. Deep ploughing, therefore, simply buries the soil and subsoil below a raw clay, in which seed is just as unlikely to germinate as it would on the bare surface of any unweathered bed-rock.

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ALLUVIAL SOILS.—Superficial alluvial deposits consist of disintegrated and decomposed rock-materials which have been transported and spread out by water. Some of these formations have been accumulated in fresh water, others have been laid down in estuaries and upon the sea-floor. They and their soil-caps naturally vary much in character. The coarser deposits consist of water-worn shingle and gravel, which, as they rapidly absorb rain, are usually barren. When the interstices amongst the stones are filled with finer grained materials—grit and sand,—a light porous soil is formed. Between such coarse accumulations and the finest mud and silt, all gradations occur. Although some alluvial sands are infertile, yet such is not often the case, for the finer arenaceous alluvia usually contain larger or smaller proportions of clay, and not infrequently form loamy soils of good quality. From loams capable of high cultivation, we pass on to clays, many of which are tenacious—although no alluvial clays are so stiff and tenacious as the tills and stoneless clays of glacial origin. Moreover, alluvial clays, muds, and silts often contain much organic matter, and are frequently rich in soluble mineral salts. The chief distinction, however, between alluvial and glacial clays is simply this, that the former consist essentially of mineral matter in an advanced state of decomposition, and, therefore, readily assimilated by plants, while the latter are composed almost exclusively of undecomposed mineral matter—of crushed and pulverised rock, which had previously experienced little or no chemical alteration.

ÆOLIAN SOILS.—In this country the only important accumulations of æolian origin are the sand-dunes of our low-lying maritime districts. As the dominant ingredient of these sands is quartz, they can hardly be said to yield a soil. Nevertheless, certain sand-loving plants find sustenance upon them, and succeed in binding the loose particles together, so that eventually some humus is accumulated, and a thin soil is formed. In other regions, however, the fine dust swept by the wind from dry desiccated regions, and distributed over adjacent tracts, has not only added to the fertility of such tracts, but in some cases has accumulated so as to form thick sheets of the finest loam, which cover and conceal the native soil-caps and bed-rocks of extensive areas. The fine loams of the Rhine Valley and the low grounds of the Danube, and the far-spreading "black earth" of Southern Russia, are believed to be of wind-blown origin.

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In the first of these articles (see Vol. XX. p. 178) reference was made to the fact that disintegrated rock-material is constantly travelling, slowly or more rapidly as the case may be, from higher to lower levels. This is, of course, most perceptible on hill-slopes, and in places where the ground is periodically ploughed, and the soil exposed to the mechanical action of the superficial agents. The soil derived from some particular kind of bed-rock or superficial formation must thus come to invade and overlie subsoils and bed-rocks of a different character from that which gave it birth. When we have recourse, therefore, to a geological map as a guide to the nature of the bed-rocks and superficial formations, it must be borne in mind that the map does not profess to show the precise limits of the soils, but the boundaries of the more important groups of bed-rocks, and overlying glacial and alluvial accumulations. For example, the map may show that a certain hilly tract is occupied by some igneous rock, say basalt. Over that tract, therefore, we may expect to encounter a dark loamy soil, but this soil will naturally extend down the hill-slopes, and thus cover a wider area than the rock from which it originated. Again, it may be noted that the colours upon geological maps refer, as a rule, only to the so-called "solid rocks," and these may or may not appear at the surface of the ground where they are represented by the map to occur. Wide regions which may be shown on the map as occupied by limestone, or by sandstones and shales, or other kinds of bed-rock, may, in fact, be deeply buried under superficial accumulations, and thus may have had no influence whatsoever on the nature of the overlying subsoils and soils. The Government Geological Survey, however, is now issuing maps which indicate the actual areas where bed-rocks are exposed at the surface, and the tracts over which superficial formations are distributed. Agriculturists and others interested are thus supplied with reliable data for forming some opinion as to the general character of the soils that are likely to be met with in the areas represented on such maps.

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20. A Scheme for Establishing a National Industry of Forestry.

By A CORRESPONDENT.

Proprietors as a class seem now to be sufficiently awake to the profit and advantage to be derived from a well-considered scheme of silviculture, but nevertheless we see throughout Scotland very little evidence of any general development of what may be called Commercial Planting. There are few proprietors of large estates interested in their improvement who cannot point out considerable parts of their property which might profitably be devoted to growing timber, without material injury to the farms but with advantage to the rest of the estate, through giving shelter and adding beauty. Some proprietors will add the remark that they would rather have trees to deal with than tenants. The former never grumble—if they have complaints they keep them to themselves; there is no fear of their agitating for troublesome legislation; and if there is too big a stock of game, no ill-feeling is bred.

Why is it that so little commercial planting is being done in Scotland in spite of these advantages in the eyes of the landlord, and in spite of the small net return now to be got from farming land of inferior quality? The reason is not far to seek. There are few proprietors who can afford to sink capital in planting, and fewer still who, if they can afford it, are inclined to part with their money in the certainty that they will get little or none of it back, however great may be the return to their successors at some remote date.

Nor can we wonder. Few proprietors who have money in addition to land will incline to reduce their incomes for the rest of their lives by investing it in a private enterprise which cannot possibly yield them any return; and fewer of those who have land and no money will choose to burden themselves with the interest charges and expenses which will be the only outcome to them of sinking a large sum in planting—for commercial planting can only really be successful on large areas of ground, even if the plantations are gradually formed. Indeed, it might, in many cases, be rather an additional burden than a relief, that the money expended in planting would have to be borrowed in instalments. Apart from the interest charges, a hard-up laird

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will consider that he will lose some income from loss of rent for the planted land, even though the land be poor and the rent small.

All these circumstances lead to the conclusion that if commercial planting is to be seriously developed in this country, some furthering scheme of finance must be devised. Government loans at once suggest themselves, as they do in the case of most well-intentioned schemes that cannot quite stand on their own legs. If one regards this scheme as for the benefit of the public, and especially for the benefit of the working classes in developing a great industry which will employ labour in the most healthful conditions, it seems a clear case for opening the nation's purse. But in these days of dear money and national economy, with heavy demands for educational and other public purposes, Government money is extremely difficult to get, and, if it is obtainable, it must be on terms that will strongly tempt the Chancellor of the Exchequer to loose the strings of the nation's purse. Can such terms be proposed? To answer that question is the purpose of this paper.

To tempt the Government successfully, two conditions must, if possible, be attainable—(1) immediate and substantial public advantage through the expenditure of the money provided; and (2) ultimate financial success, and the return of the money to the nation's coffers with a sufficient interest or profit. My object is to show how both these results can be attained, with reasonable if not indeed absolute certainty, in the case of commercial planting at the public expense.

The first condition should not be difficult to fulfil. Any commercial planting scheme should be carried out gradually, the area to be ultimately dealt with should be large, and there should be regularity in the extent planted each year. This means steady and continuous work for those employed in planting up the land and managing the woods, over a long series of years, even though the work may only cover a portion of each year. This latter point I shall deal with immediately. Following the correct modern system of silviculture, a definite plan or course of cropping should be followed, under which the plantations will come to maturity as far as possible in regular divisions. Under this system the areas will be planted in regular and equal divisions, and the intermediate thinning operations will likewise fall to be carried out in equal and consecutive parts. Thus the forest

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work should be regular and constant in quantity each year, and its amount should steadily increase. To commence with, a definite acreage would be fenced off, prepared and planted each year, and in connection with this a definite and regular amount of nursery work is required in growing the seedlings to supply the plants. After a few years the first planted division will be ready for thinning, and continuously thereafter this work will be added to the planting. Ultimately the cutting operations will be added, division by division. Thus it will be seen that a steady and increasing amount of labour will be called for year by year, until the entire forest has been fully constituted. It will be noticed that while those different operations can be carried on at different times, most of the work falls to be done in the winter months. This suggests the suitability of combining the forest work with agricultural employment, the latter work being more constant in the spring, summer and autumn months, and the possibility of connecting with such a scheme of commercial planting, small agricultural holdings to be let to employees with enough land to keep them employed at such times as the forest does not require their labours. This, too, would help to spread the work provided over a larger number of men, and there can be no doubt that ordinary agriculture and forestry are sufficiently kindred employments to let a man be good at both, and that in most forestry work there is sufficient elasticity as to times and seasons to allow successful farm work to be carried on alongside.

Any large scheme of commercial planting can thus suitably include a scheme of small holdings, and in the selection of areas for planting care should be taken to secure suitable land for small holdings near by, so that both schemes may develop hand in hand. Apart from the employment of the men, there will be considerable mutual advantages as regards horse labour, not only in winter, but in carting thinnings and cut timber during the intervals in summer when farm work slacks off, and on days when the weather does not suit for tillage or harvest. Of course the arrangement of the work, so that it may be carried on harmoniously, efficiently and economically on these lines, implies supervision by a competent head forester.

The second condition of the proposal, namely—ultimate financial success, involves the necessity for careful selection of suitable areas, and also strict provision to secure constant good

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management. Enough has been written of late in proof of the fact that on suitable land in Scotland timber can be grown not only to yield, at present prices, an adequate return on the outlay, but probably to yield a handsome profit. The proofs of this apply particularly to the low-rented, light land specially suited for the growth of larch, which includes a large part of the Highlands, where the soil and climate favour that tree. But the careful selection of suitable areas for commercial planting must always be a fundamental condition for ensuring success. Fortunately the subject of silviculture has been taken up in recent years so seriously and scientifically in this country, that there need be no difficulty in obtaining skilled advice as to areas suited for successful commercial planting, having regard to soil, climate and accessibility to market.

The question of the actual value of the timber seventy or eighty years hence must remain, of course, more or less problematical. Unless, however, timber is going to be substantially superseded by some other material, there seems no ground for doubt that, having regard to the steady diminution of the supplies of timber within easy reach throughout the world, the demand must continue to be at least as great as at present—indeed, the serious fear is that the demand will far outrun the supply, at least for all kinds of fir wood. But even though reasonable profit may be regarded as well assured, what security can be given to the State that it will receive its full share of this, and that it will not all go into the proprietor's pocket? The proposal has been made that the State should buy out the proprietors of suitable land for planting, and we are often told that there are plenty of estates in Scotland which can be purchased at a fair price, like Inverliever on Loch Awe, which the Government bought recently to form a forestry station. But is the country prepared to sink large sums in buying land for planting, and would it be likely to be able to buy land suited for planting without also encumbering itself with farms, mansion-houses and shootings which it could not use to profit? Moreover, we may be sure that at the best the money the Treasury would agree to give would be limited, and the more spent in buying land, the less there would be left for the direct purpose of creating a silvicultural industry. This condition drives us back to consider the possibility of devising methods of applying the money so that it be expended for planting purposes alone.

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A simple method would be by long period loans to the proprietors of suitable land on sufficient security. No doubt a mortgage might be given by the proprietor over his estate for such a loan, but as the advance would be spread over many years, the amount of the mortgage required to secure it must be uncertain, and difficulties would arise on this account, particularly in the case of heavily-encumbered estates. Moreover, strong objection would certainly be raised by many people to the Government lending on terms that would really imply its taking all the risk and the proprietors getting the whole surplus profit at the end, after paying off the capital expenditure and the accumulated moderate interest. Such would indeed be too favourable terms to the proprietors, whose personal obligation for payment of the debt and interest, if any were given, would be postponed to so remote a date that no reliance could be placed upon it. How, then, could the State be secured of a fair share of the ultimate profit commensurate to the capital contributed to the undertaking? This might be effected under a system of joint account, the Government, however, retaining the power to secure efficient management, and having a prior lien over the subjects for its fair share of the timber profits.

The plan could be worked out in this way,—a proprietor of suitable land would offer it for a planting scheme on the footing that its value for present letting purposes be placed to his credit in an account to be kept by a Government Forestry Department. To this account the Government would contribute all the expenses connected with its utilisation for forestry purposes, and these sums would be placed to its credit. Interest on the respective credit balances would be added periodically, but when the forest became revenue-producing, interest would stop, and a balance be struck, and thereafter the net annual returns, after meeting all expenses, would be divisible proportionally to the amounts standing at the credit of the Government and the proprietor respectively. Connected with the land actually to be planted, suitable land for occupation by those to be employed might be permanently rented and let to the employees.

The management of the forest might generally be left to the proprietor of the estate. His management would be usually more economical and careful than that of Government officials from a distance, but strict conditions would be necessary to guard against mismanagement or neglect. The general lines of

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management would be laid down by the Government department, —the head forester would be a man whose qualifications had been approved by the department,—the work would be carried out on the basis of annual estimates, and the woods would be inspected from time to time by the department's representative. If the management for any reason proved unsatisfactory, the department would step in and take it into its own hand.

The legal form in which such a scheme could be constituted might be a simple conveyance of the land included in the scheme to Government with a back agreement setting out the terms of the arrangement, including the return of the land to the proprietor or his successor at a fair value if and when the scheme was wound up. The holders of any mortgage would need to concur in the conveyance, but in return they would receive an assignation in security of the proprietor's interests under the forest agreement.

The general result would be the establishment of a forest under Government for public and private benefit, on land belonging to a private owner and under his private control so long as well managed. Undoubtedly the bogey of "dual ownership" will be set up to frighten people from such a scheme. But, after all, have we not more or less of dual control in almost every undertaking? Who is free from State control and State interference in their business? Take, for instance, the railway companies: they have the Board of Trade revising their management in every detail; they have to admit public rights in the use and control of their property as a condition of the powers and privileges they enjoy. Yet does the system prove unworkable in this country? Again, we have the factory and mines inspectors interfering in the management and conditions of industries. Yet apart from an occasional growl, no harm is done and often great good. In the case of such a co-operative scheme as is roughly suggested above, friction and differences of opinion would be less likely, inasmuch as the Government and the proprietor would alike be interested in its financial success and in the welfare of its local employees.

Undoubtedly the establishment of a Forestry Department would be required for Scotland under Government to control and supervise the working of such a scheme, but it is a national concession to be pressed for on every ground. A Department of Agriculture and Forestry should be given us to remove the

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humiliation we feel in having to go to Whitehall in all matters of public business affecting Scottish agriculture, and even in private business, to settle the most trifling disputes between a laird and his tenant, for it is there they must apply before an arbiter is named. It is indeed no drawback to this scheme that it might call for more local attention to forestry business by Government, and emphasise the advantages that will be gained through the establishment of a Scottish Experimental Station as a basis for practical forestry work.

Let us see how such a co-operative scheme as is above suggested would work out in practice. Imagine it applied to some Highland estate near the west coast of Scotland, with a considerable extent of hill land, at present used for deer or for carrying a moderately healthy stock of sheep. Suppose a considerable belt of the land available above the lower arable and pasture land to be of the free open soil that suits the larch, not too high for profitable tree-growing, and within easy reach of an arm of the sea or other road to market. Perhaps there is a small neighbouring population, poorly employed on their crofts. Anyone who knows the Highlands at all can readily recall such a place. The proprietor wishes to establish a permanent industry for the people, and to do something for his country and for his successors in his lands by commercial planting, but has no money to invest in such a scheme, and cannot borrow more on his heavily-mortgaged estate. He finds opportunity to very gradually withdraw such land as is described from sheep or deer, at no very serious sacrifice of rent, to an extent in all of say 2000 acres. So he applies to Government to join him in putting in practice these good intentions. The Government inspection is satisfactory, and the exact extent of land to be included in the scheme is adjusted and planned off. The present value of the land for its ordinary purpose is agreed on, a planting plan and system of management is adjusted and an agreement signed. The lands to be ultimately included are say 2000 acres, worth £3 per acre, 25 acres to be planted each year, with croft and grazing land worth say £50 per annum attached.

In the first year a nursery would be formed to provide plants after the first two or three years. The first 25 or 50 acres to be planted would be fenced off, drains cut, and a 25 acre division might be planted at a cost of say £5 per acre planted—or £125 per year. The cost of this work would be estimated each

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year, and the amounts passed paid by Government and placed to its credit in the account, the proprietor being credited with the agreed value of his land taken possession of each year. The croft and grazing land would be dealt with as might be arranged —perhaps that the proprietor would continue to receive the same rent as the land brought when taken over, the Government defraying the costs of any buildings or other improvements required, and being credited therefor in the account. Each year would add similarly to the capital contributed on each side, till the years were reached when the crops of trees became saleable and further capital expenditure would cease, and returns came in to the Government and the owner of the land. Meantime more and more labour would have been required, and more and more men employed.

This is an example of the scheme worked out on a modest scale—25 acres per annum—but the larger the scheme the better the results would be, as the larger undertakings would justify the employment of more skilled and better paid managers, and would in various ways secure greater economy. Nor would there be any insuperable difficulty in two or more proprietors being associated in one permanent scheme along with Government.

The advantages which would be attained in securing continuous good management of the forest areas dealt with, and in facilitating the establishment of forestry stations in different parts of the country under Government control for scientific study, have not been touched on above. These and the climatic improvement to the districts in which such large masses of trees would be introduced, are considerations which must not be overlooked.

Undoubtedly this scheme would mean the sinking for many years of public money—mainly in wages paid out for work —but would the nation grudge this to establish what would really be a new national industry under the healthiest conditions of life and work? The expenditure would be very gradual, while the benefits to the nation would be immediate, substantial and increasing.

[We hope that these interesting suggestions will be fully discussed by other writers.—HON. ED.]

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21. Root Disease in Scots Pine on Farm Lands.

(With Two Plates.)

By BERT. RIBBENTROP, C.I.E

Does any direct connection exist between root disease in Scots pine and the condition of the soil on farm lands? This is the question which has been propounded by Professor Dr Albert. Prior to his investigation, the ravages of *Polyporus annosus* had assumed disastrous dimensions, and seemed to be in process of increasing, both in virulence and extent, in all parts of the Continent. In northern Germany especially the ever-increasing destruction of afforested lands constituted a grave calamity, for since the middle of last century very extensive areas of farm lands had been afforested—chiefly with conifers—in the pious but unrealised hope that inferior fields would become at once productive forest. How can Scots pine forests, grown on old fields, be saved from total destruction by *Polyporus annosus*—became the question put on all sides, by private owners and at forest conferences. It was only in 1902, however, that Professor Albert was officially entrusted with the solution of the problem. That he was the right man for the work no one who follows the logical sequence of his scientific work, and the guarded nature of his deductions, will be disposed to deny. We sincerely hope to hear more of his valuable researches, especially in regard to the afforestation of heather lands.

When Dr Albert started on his work, it was the general belief that the attacks of *Polyporus annosus* were the prime cause of root disease in pines: that a virulent and frequently fatal disease existed prior to fungoid infection was not known, although a predisposition to fungoid infection on farm lands was generally believed in. All sorts of speculative explanations were given of this predisposition, such as the presence of animal matter in the soil, etc.

The history of Scots pine on old farm land is always the same —a particularly rapid development of the young crop takes place in the early stages; after some years the growth in height ceases somewhat abruptly, and this is followed by the death of single trees here and there. From these centres the disease spreads in ever-widening circles, which only change their form when they meet. The first deaths occur between the ages of 8 to 10 years, and trees of upwards of 60 years old are safe.

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The disease varies considerably in its degree of virulence; in many cases only twenty trees per acre escape, in others a large percentage of the original crop may survive, but it is very rare to find that a full crop reaches maturity without active artificial measures of amelioration, by the interpolation of other species.

The circular expansion of the disease proves without doubt that it is spreading by root contact, and that *Polyporus annosus* is the immediate cause of death. All visible signs, moreover, point to this fungus as the original cause of the disease, but as all direct infection experiments on growing roots failed, Dr Albert refused to accept this view without further inquiries and direct proof. No instance had been observed of the fungus attacking trees growing on forest soil, although mycelia and spores of *Polyporus* and other similar fungi are found everywhere in the immediate vicinity on dead and rotting wood. This fact suggested that, whether *Polyporus* was the primary cause of the disease, or was merely a secondary infection, the predisposing cause must be looked for in the condition of the soil on farm lands, and this was where Dr Albert looked for it.

In the first instance, he verified by personal observation the fact that Scots pine and red pine planted on farm land, whether the original soil was rich or poor, were invariably attacked by root disease. Second, he found that where the first crop had failed, and the area was restocked with the same species, the disease greatly increased in virulency.

Dr Albert next made, in numerous localities, careful and searching analyses, physical[1] as well as chemical, of soils on

[1] The chemical constituents of the soil can be fully utilised only if the physical ones are favourable. We obtain the most reliable picture of these conditions by measuring the porosity of the soil, recording the result as a percentage. Thus a porosity of 40 per cent. would mean that 100 parts of soil contain 40 per cent. of hollow spaces and 60 per cent. of solids. This gives us a direct measure of the density of the soil, and shows us at a glance how air and water circulation are affected. Numerous and reliable observations can only be made on the spot, but nothing is easier. All that is required is a specially constructed steel receptacle of known dimensions and weight (Ramann's), by means of which equal portions of the soil can be taken up in their natural position, a very accurate scale, and a number of air-tight tubes of known weights. The exact weight of the soil taken out by means of the steel receptacle is ascertained on the spot and recorded, and specimens of the same soil are put into the test-tubes. Those specimens are carefully tested in the laboratory as regards water and specific weight. This done, the porosity percentage can be ascertained by arithmetic.

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existing farm lands, on afforested fields under pine crops of various ages, and on the adjoining forest lands. The physical analyses were always made on the spot, which naturally is the only way of obtaining reliable results. The chemical analyses of the various soils showed in no instance sufficiently pronounced differences to account for any marked changes in the growth of the crop, for although a gradual decrease was observed in the percentage of humus and nitrogen in the surface-soil of farm lands, which had been for some time under Scots pine, this was nowhere considerable enough to produce any marked decrease in the rate of growth, and certainly could not cause its entire cessation. A remarkable and constant difference was, however, found to exist between the physical condition of forest soils and of farm-land soils. The porosity of the latter was invariably much less than that of the soils in adjacent forest tracts, and this difference increased in most cases down to a depth of 12 to 18 inches and more. In many instances the porosity of farm lands fell below 40 per cent. Dr Albert's researches proved that no improvement had taken place in these conditions, or at least the very slightest only, on areas under a pure Scots pine crop, but that, where Acacia had been planted in destroyed portions of the original pine afforestation, the forest soil conditions were produced in an incredibly short space of time. It was found that the same physical conditions had established themselves on farm-land areas which had been afforested 65 years ago with a mixture of Scots pine, beech, and birch. No root disease ever took place in these crops, though they were surrounded by especially severely attacked afforestations of pure Scots pine. Even an inter-mixture with equi-aged oak was found to have protected the pine from root disease, and to have restored the forest soil condition to a considerable extent.

As soon as Dr Albert had established the existence of a constant difference between farm-land soil and forest soil, he assumed that if the disease was due to this fact, then all trees growing on farm lands should show at least primary symptoms of the disease. This proved to be the case. As Dr Albert began his detailed studies of roots only after he had finally established the existence of an unvarying difference in the physical condition of the soils, his observations in this respect are not spread over as many localities, but they are nevertheless very instructive and convincing.

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The early primary symptoms of disease are very widely spread, and Dr Albert found them on upwards of 90 per cent. of all farm-land grown Scots pine. They are easily recognised in the shape of dark or black spots on the still living roots, which in these places contain a more or less decomposing fluid, and frequently exude resin. The first appearance of these symptoms was usually observed on the wide-spreading surface-roots, entirely unconnected with each other, thus showing that the disease starts simultaneously in many places. Numerous entirely dead roots were also found in every case. The fact that practically every Scots pine tree grown on old farm land suffers from a root disease, seems to have been proved, but that this disease kills a large proportion of the trees it attacks is at least doubtful. The actual slayer is, unquestionably, *Polyporus annosus* or one of its relations. At what period of the original root disease this scourge begins to take an active part in the work of destruction, and in what condition the roots have to be to allow it to thrive, are questions which merit the most careful investigation. Without this secondary attack, a regeneration of the root-system—though this remains marked with numerous scars—seems mostly to take place; with it death is the inevitable fate of the tree.

The root-system of the Scots pine growing on farm land is quite different from that of forest-grown trees, for though the young plant develops long tap-roots, these are mostly smooth like a carrot, without bifurcations or branches, and the side-roots—which start from the very root necks—keep almost entirely in the upper layer of the soil. This may be because they find easily assimilated food near the surface, and experience more difficulty in penetrating the soil, which is denser than nature intends them to penetrate under ordinary circumstances. Dr Albert suggests that this surface position of the roots exposes them to periodical and rapid changes between excessive moisture and drought, thereby starting the disease. He may be right, and the reasons he gives for his belief are not without value; but here we enter the field of speculation, and we must leave it to physiologists and mycologists to ascertain the exact nature of the primary disease and the course it runs. All I think we can safely accept is, that on the Continent a primary pine root disease is universal on all afforested farm lands; whether, however, the disease is as active in England is a matter for inquiry. The soil conditions must be subject to the same laws, but it is conceivable

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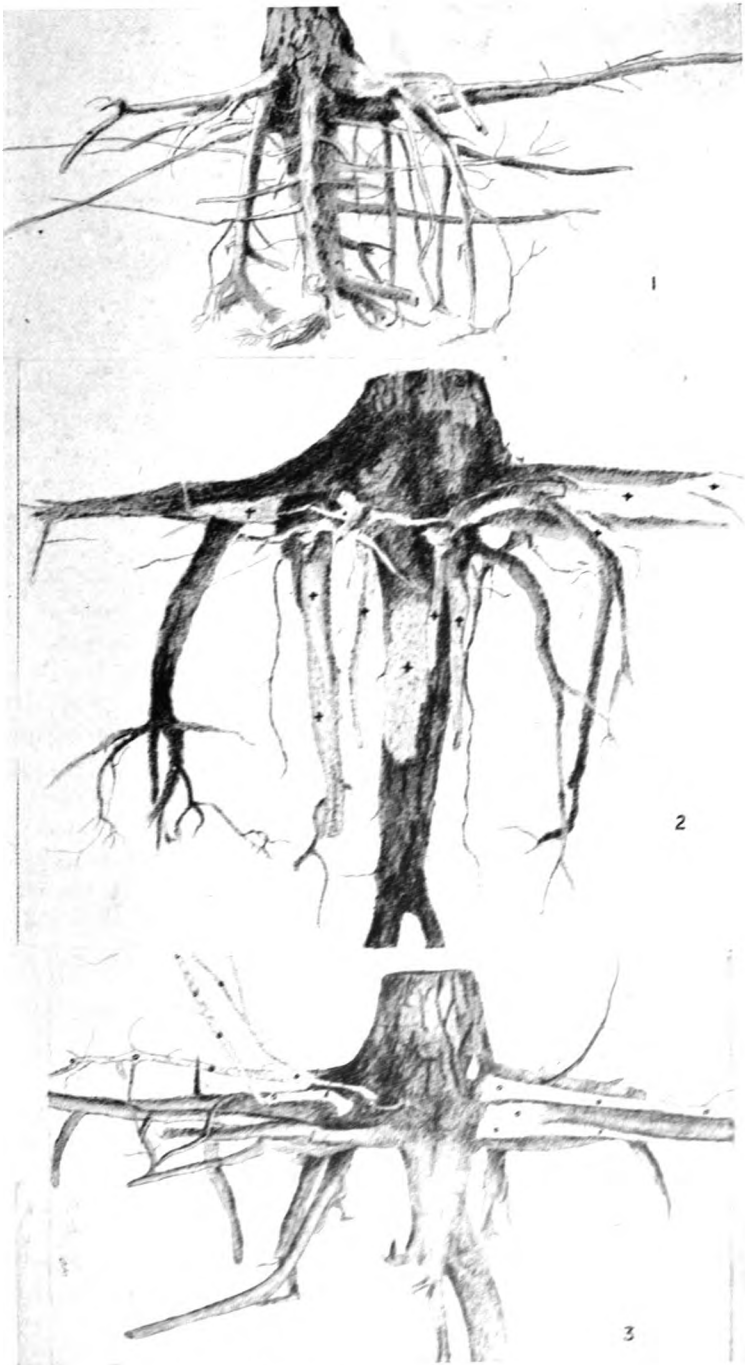

ROOT DISEASE IN SCOTCH PINE.
(For explanation see Text.)

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that the greater equality of the climate does not encourage the actual outbreak of the disease to the same extent.

The early cessation of growth, and the gradual dying-out of both Scots pine and red pine, in the very extensive State afforestations of heather tracts in the north-western parts of Germany (Luneburger Heide), had for a long time been ascribed to the inherent poverty of the soil, but laboratory analysis proved that this conclusion was not quite tenable. A commission of inquiry was then appointed, of which Dr Albert became a member in 1906. When he examined the soil of the afforestation area in question, he found that exactly the same conditions prevailed here on heather lands as he had observed on farm lands; the same vigorous growth for some years, and the same attack by a primary root disease, ending in death, occurred if *Polyporus* took the field. This of course does away with the animal manure theory of the causation of the disease.

It is then at present believed that Scots pine and red pine are invariably subject to root disease, if cultivated on any other but forest land. This would naturally apply to the larch as well, for it also is not a soil-improver. The trees, as explained above, do not all die if not infested by the fungus pest, but, under the most favourable circumstances, they lose years of growth whilst readjusting their root-systems by sending down vertical branches from their surface-striking side roots; and all this time they are doing nothing for the next crop.

These facts are very serious for this country as well, for *bona fide* forest soil is not too plentiful in Great Britain, and, if our pine and larch crops on other types of soil should fail, and prove liable to fungoid attacks, the present undoubtedly growing enthusiasm for afforestation with pines and larch would die out.

We may be certain that further researches will be made in Germany in the direction pointed out by Dr Albert, especially by the Heather Afforestation Commission; but we should not stand aside, but should institute investigations of our own (always to be made on the spot) as regards the comparative physical condition of soils on forest lands and on farm, heather and waste lands, and should study the root-systems of our pines under the various soil conditions, and examine them for disease spots or scars. I consider it quite possible that, owing to the climatic conditions, the results of researches in this country will prove more favourable in every respect than on the Continent.

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The question naturally arises, how can the primary disease be prevented, and what steps have to be taken when the crop has been attacked? Prevention is certainly easier than cure, and, to judge from the investigations so far as they have gone, it would seem to be sufficiently safe to cultivate Scots pine or any other conifer on farm or waste lands, after establishing forest-soil conditions by a preliminary crop of some soil-improving species. Even a liberal admixture of such species, Acacia in preference, with an original pine crop would probably suffice to prevent any root disease. When the young growth has been attacked, the stems that lag most behind in height-growth, especially those which have sent out no new shoots at all, should at once be removed, and replaced by some fast growing soil-improving species. To sit and await results means merely waste of time, and is courting further disaster.

We have no absolute proof that the spread of *Polyporus* when it has once established itself in a diseased afforestation area can be controlled, but experiments with isolating ditches made over an area of over 2000 acres, by Herr von Klitzing, Charlottenhof, have so far had the desired result. This the owner of the forest ascribes to the early application of the measure, for as soon as a young stem was seen to be in a dying condition, it was at once surrounded with a circular ditch of 30 feet diameter. These forests have not yet passed the critical age, but favourable reports regarding the efficacy of the measure are also received from France, and any forest owner would be rash not to try isolation.

In India, the field of my former labours, most of the pines, especially *Pinus excelsa*, but also *Pinus longifolia*, which is certainly no soil-improver, take fairly rapid possession of deserted fields, but still this is a gradual process, in which bushes of all sorts probably play a considerable rôle. Only once, in 1871, did I try my hand on sowing some old fields with *Pinus longifolia*. The first results were excellent, but when I returned in 1883 no vestige of my attempt was left.

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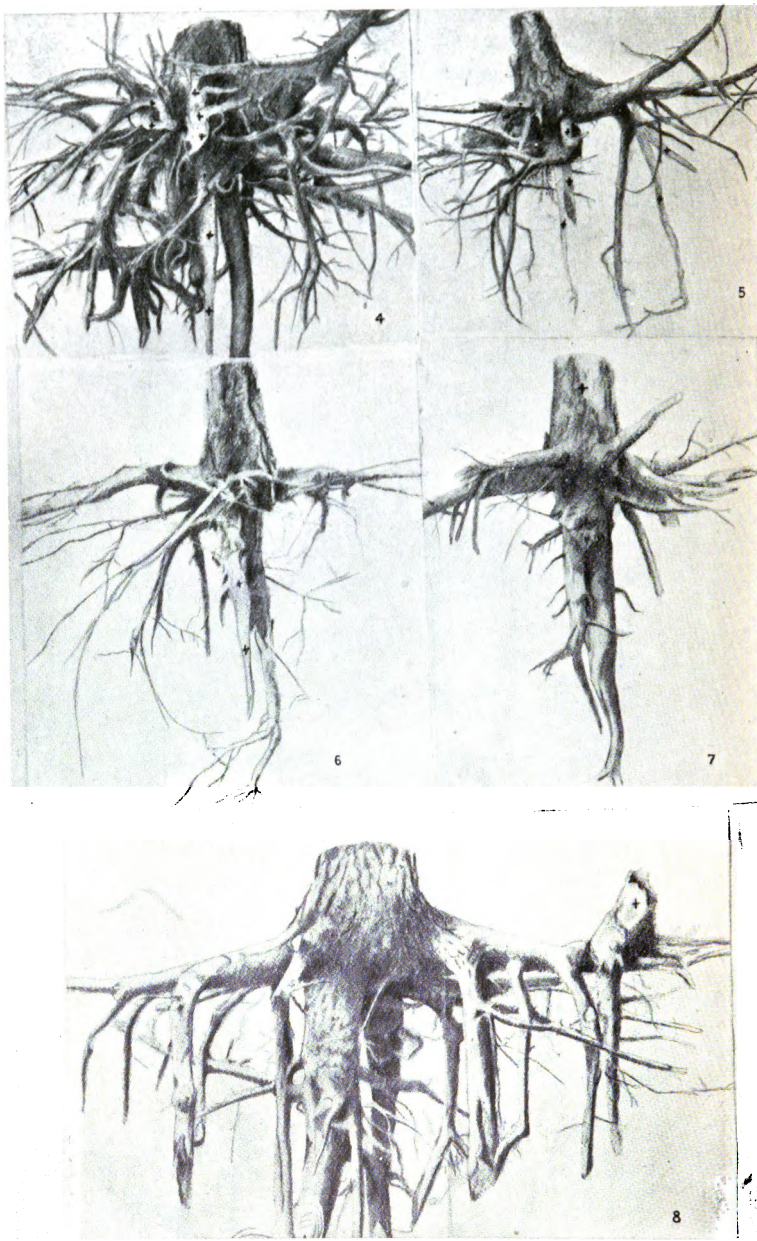
Plate XII.



ROOT DISEASE IN SCOTS PINE.

(For explanation see Text.)

To face page 149.]

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Explanation of Plates.

The accompanying Plates, which are drawn from Photographs, show Scots pine roots grown on old farm lands.

Figs. 1 and 8. Roots of trees growing in close portions of otherwise severely attacked afforestations—55 and 60 years old. Neither of these roots systems shows any traces of the disease, and they are almost normal in their development. They represent exceptions.

Fig. 2. Roots of a 50 year old tree left on a large blank—its foliage was still normal, but height-growth had almost ceased for some years. The tree was, however, still struggling with the disease.

Fig. 3. Roots of a 45 year old tree, in a heavily diseased area, still living but doomed; the foliage was thin and off colour. The shape and development of the root system are quite typical of those of farm-land grown Scots pine.

Fig. 4. Typical formation of roots of a tree that has got over the disease after a severe struggle. The tap-root was dead, but had been replaced by numerous deep-reaching branch roots. The crown development, also typical, showed by its rounded formation that for a considerable time no growth in height had taken place, but a vigorous shoot growing out of it proved that the crisis was over.

Figs. 5 and 6. Roots of trees 45 and 50 years old, which had passed the crisis and were convalescent. The regeneration of the root system had established itself, and growth in height had recommenced.

Fig. 7. Roots of a dying tree, 40 years old. A severe struggle for life was evidenced by the formation of a second large root, after the first had died.

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22. The Cultivation of Hardwoods.[1]

By J. Boyd.

II.

It is my intention, in continuing this subject, to express briefly my opinions regarding the formation and cultivation of hardwood crops, the method of treating the subject being to begin by making some general remarks; then to refer to the principal broad-leaved trees individually, with a short reference to the tending of woods composed entirely of these; and lastly, to mention some cases where it may be permissible, or even advisable, to have a mixture of conifers with hardwoods.

Trees in general—hardwoods included—may be cultivated either in "pure woods" or in "mixed woods," and the latter may be either "even-aged" or "uneven-aged." Although these terms are now more or less familiar, it may be advisable to state briefly what they imply, and what is the object of having mixtures. A pure wood is one composed of one species of tree; there may be stray trees of other species throughout the area, but they are ignored in the management, the whole being treated as if there was one species. On the other hand, a mixed wood is one composed of two or more species of trees, and, as already stated, it may be even-aged or uneven-aged.

(*a*) Even-aged Woods.

In this case there are four different methods of mixing, any one of which may be adopted, according to circumstances:—(1) by single plants; (2) by alternate lines of different species; (3) by strips—or several lines—of each species; (4) by groups.

1. In the case of a mixture by single plants, the mixture should be composed of two kinds of trees—and two only—or at least two kinds only should grow together on any given area of a wood, *e.g.*, oak and beech might be the principal crop in a wood; but if it were desirable to introduce, in suitable places, such trees as ash or elm, they should not be mixed with the oak and beech, but should be planted, instead of the oak, along with the beech. This method of mixing is suited only to soils which are more or less regular in character, and on which

[1] Continued from page 49.

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the oak will have a good chance of holding its own with the beech; otherwise the latter will tend to suppress it, and to prevent this in a situation which favoured the development of the beech would be a well-nigh hopeless task.

2. A mixture by single lines should, like the former, be composed of two species of trees planted in alternate lines, and is only suited to situations which will favour the growth of the light-demanding species. The advantages of this system over the former are—(1) that the planting is simpler, and (2) that the trees are more easily tended in youth.

3. A mixture by strips, which is a modification of (2), is composed of several instead of single lines of each species planted alternately. It is suited to a soil and situation which will be likely to favour the development of the shade-bearing species; because in this method the light-demanding plants can be more easily fostered by checking the growth of the other.

4. *Mixture by Groups.*—A mixture by groups is one composed of groups of various kinds of trees, or, in other words, an aggregation of miniature pure woods, a proportion of which must be good soil preservers, these being so arranged that they may be of the greatest advantage in maintaining the fertility of the soil throughout the wood. Such a mixture may be composed of as many kinds of trees as the nature of the soil and situation will accommodate or necessitate, and is preferable for a variable soil; but in the formation of such woods great care and judgment are required to ensure success. In some of our best hardwood-growing localities, it will frequently be found that within the area of an ordinary sized wood such vagaries are met with in the soil that the adoption of the group system on certain parts will be most advantageous. In such cases it may be not only permissible, but advisable, to combine this system with any or all of the preceding ones.

(*b*) Uneven-aged Woods.

In this country uneven-aged mixtures are not very common, but as time goes on they may become more so where heavy timber is required. Such mixtures will, as a rule, be started as pure woods, or as mixtures of light-demanding trees, and will be cultivated as such until about middle life, when they will be gradually thinned out to a certain number of trees per

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acre, and underplanted with a good shade-bearing and soil-preserving species.

The Object of Mixtures.

The object of having mixed woods in preference to pure woods in the case of hardwoods is twofold—(1) to preserve the fertility of the soil; (2) to improve the quality and outcome of the timber.

1. Some trees are capable of maintaining or improving the fertility of the soil, whereas others are absolutely incapable of doing either; indeed, under a crop of such the soil is certain to deteriorate, and it is a notable fact that the most valuable of our hardwood timber-trees belong to this class: therefore in forming a mixture, one of the species of trees must of necessity be one which will be capable of preserving the fertility of the soil.

2. Certain trees, and very notably oak, if grown in pure woods, are apt, in middle and later life, and particularly after a heavy thinning, to develop, from dormant buds in the stems, a crop of shoots which are a very serious objection, insomuch that they do incalculable harm by reducing the quality, and therefore the value, of the timber,[1] and it is most essential that such a state of affairs should be prevented. All situations and localities are not alike subject to this evil; the danger, other conditions of management being equal, seems to be in inverse proportion to the suitability of the soil for the development of the trees. If by any chance, however, a crop is allowed to get into a bad state with side-shoots, there is practically no cure. Therefore, as already mentioned, the plan is to prevent the evil, and this can only be attained by having such trees properly mixed with shade-bearers. The proportion of shade-bearers required to prevent this will depend largely on the nature of the soil, fewer being necessary on a deep fertile soil than on a poor shallow one. Of course it is quite possible to grow a crop of hardwoods of light-demanding species on a soil of high quality without any risk of injury from the cause referred to; but if the preservation of the soil be considered as well, it will be found that under such a crop, with a long rotation, the soil will have deteriorated. There is therefore

[1] And by tending to render the timber "stag-headed."—Hon. Ed.

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only one conclusion to be arrived at if the two objects of mixtures be considered conjointly, and that is, that for the proper cultivation of the most valuable hardwoods a mixture with shade-bearers is absolutely necessary.

Individual Trees.

Oak.—In speaking of mixtures, a good deal has been said regarding oak, indicating at least its characteristics, but as it is considered the premier tree among our hardwoods, a little repetition may be pardoned.

It stands high in its demands on the locality, requiring for its proper development a soil of good quality and depth. It is decidedly a light-demanding tree, being even sensitive to side shade, and after early life is about the worst soil-preserver of all trees. When young, that is until it has passed the pole stage, it will protect the soil to some extent, but afterwards it opens up very rapidly, and the light penetrating the open canopy encourages an undergrowth of grass and other weeds which utilise the humus on the surface of the ground, thus depriving the trees of much nutriment. As the wood gets older, there is added to this the worse evil of the loss of humus through the wind blowing the leaves either out of the wood altogether or into ditches, hollows, or depressions, thus robbing some parts, if not the whole wood, of its natural fertiliser. The leaves of oak are slow in decomposing, and are thus very subject to being blown away, so much so that the leaves of the previous year may be found blowing about in late spring. To cultivate oak on a successful basis, means must be taken to counteract these tendencies, or the certain result will be deterioration of the soil, and consequent loss of annual increment, and this can only be averted by mixing it with another species which will supply the necessary density and protection to counterbalance the deficiencies enumerated. Beech is the tree which, by all authorities, is considered the most suitable for this purpose.

Beech.—Like oak, beech requires a soil of good quality, although it is not so exacting as to depth. It is decidedly a shade-bearing tree, having a dense crown which at all stages of life forms a canopy sufficiently dense to keep down any undergrowth which would be detrimental to the soil. It also

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makes a good wind-break, thus reducing the chance of loss of humus through blowing of the leaves, which are very abundant, and form a rich and plentiful supply of humus. Beech leaves are quite as slow of decomposition as those of oak, but they lie more closely to the ground, so that, apart from their being better protected, they are in themselves less liable to be blown by the wind. This combination of qualities possessed by the beech enables it not only to protect, but even to improve the fertility of the soil, and in it, therefore, are found the qualities which are deficient in the oak, thus making it a suitable companion for that tree. It is scarcely necessary to add that, if desired, beech may be grown in pure woods; but if it has its proper place in the cultivation of oak, there is not much chance of it being necessary to cultivate it thus, excepting under circumstances where it will be more profitable to have it grown alone.

Hornbeam.—In situations where beech is apt to suffer from frost, hornbeam is recommended as a suitable companion for oak. It possesses all the qualities of the beech in a lesser degree, and should only be substituted for it when the climatic conditions necessitate its use.

Ash.—From a commercial point of view, ash as a timber-tree stands on about a level with oak. Its requirements as to soil and light are also somewhat similar, except that it requires a little more moisture in the soil. Its capabilities as a soil-preserver are, however, considerably higher than those of the oak; this is partly due to the fact that it has rather heavier foliage, and partly because the leaves decompose more quickly, and for this reason are much less liable to be blown away; but apart from all this, the compound form of the leaves render them less liable to be blown than the simple leaves of its *confrères*. Yet, with all these advantages, it cannot be recommended as a suitable tree for general planting in a mixed wood, it being, as a rule, better adapted for growing on suitable spots along the sides of streams, on the sides or in the bottoms of glens, or in fresh hollows. In such places it may be mixed with beech, but, for the reasons enumerated above, there is not the same occasion for this mixture unless the suitable areas are large; in ordinary cases, the best results are likely to be got by growing it in pure groups throughout the wood in such situations as have been referred to.

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Elm, Sycamore and Maple.—These three trees may be classed together, as the same treatment may be applied to all of them. Commercially, the sycamore is the most valuable of the three, and in large sizes it is probably the most valuable timber-tree grown. Like the sycamore, the maple is valuable in large sizes, whereas the elm is at its best as ordinary sized timber. In their soil requirements these trees are somewhat similar to ash, except that sycamore and maple do not require the same degree of moisture. In their light requirements they may be termed middle class, none of them being very exacting in their demands. They all form a fairly dense canopy, their leaves are rapidly decomposed, and not very liable to be badly blown; thus they may be ranked as *fair*, but not as *good* preservers of the fertility of the soil, and they are therefore not suitable for growing in large areas as pure woods. To cultivate them successfully, they should be treated in the manner recommended for ash, if their timber is likely to be in demand; or where the demand is not so great, by planting single trees throughout, or round the margin of, woods.

Birch.—The birch, in this country, is more frequently treated as a weed than as a timber-producing tree; yet considerable quantities of birch wood are used in various industries,[1] and if the proper variety of birch were grown, there is no reason why it might not become a more profitable tree, as it grows rapidly and comes to maturity at an early age. It makes small demands on the fertility of the soil, and will even flourish in a poor dry soil, but will do much better on a good and fairly humid one. It is essentially a light-demanding tree, and after youth affords poor protection to the soil. Little can be said from experience as to its cultivation, but presumably from its very rapid growth in youth, and from its tendency to lash and destroy the tops of adjoining trees with its whip-like twigs when subjected to even a moderate breeze, it should be grown pure at first, and underplanted with a shade-bearer when it has reached a suitable stage. Some varieties of American birch may yet prove to be useful trees in this country, and are certainly worthy of a fair trial.

There are several other broad-leaved trees which are timber producers; some of these, viz., sweet chestnut, horse-chestnut

[1] Considerable quantities of clean birch logs are imported from the Baltic and other northern ports.—HON. ED.

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and lime, need not be treated of, as they are usually planted more from an æsthetic point of view than anything else, whilst others—poplars and willows—are more worthy of passing note.

Poplars.—The black Italian and Canadian poplars—excepting the balsam varieties of the latter—are the best timber producers in this genus. They require a moderately deep and fertile soil, with a fair degree of humidity—but no stagnant water—for their proper development. They are rather above middle class in their light requirements, and afford a fair amount of protection to the soil. Their soft leaves decompose quickly, and do not blow readily, consequently they maintain the fertility of the soil fairly well. They should be cultivated in groups in suitable situations, never as single trees throughout a wood, because they grow so much more rapidly than any other trees. A crop of good sized marketable timber may be produced by these trees in a period of thirty-five to forty years, a feat which no other tree can equal.

Willow.—The characteristics and requirements of the tree willows are very much the same as those of poplars. They will stand a little more moisture in the soil, afford less protection to it, and be rather more exacting in their light requirements. The method of cultivation should be the same as has been recommended for poplars.

Tending of Woods.

It is claimed that if hardwoods—or broad-leaved trees—were cultivated on the principle advocated, the management would be simplicity itself compared with that of a compound mixture of conifers with hardwoods. In the early stages the usual precautions against weeds will have to be taken. Afterwards, when the trees have become established, and have developed into the thicket stage, care will have to be taken, when dealing with mixtures, that the shade-bearing trees do not overtop the others. When the Society visited the French forests a few years ago, a very good object-lesson for the prevention of this danger was brought before their notice in the forests near Nancy. If the hornbeam or beech were threatening to crush out the oak, the forest guards went round with long-handled bill-hooks, and wherever a good oak sapling was being threatened, he simply slashed off the tops of the offending trees, thus giving the oak ample head room, and still maintaining a complete canopy for

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the protection of the soil. This method of procedure is an admirable one, and well worth copying, and is altogether preferable to the method usually practised in this country, viz., cutting out the offending tree or trees, which, besides encouraging lateral-growth at the expense of height-growth, destroys the canopy of the wood. Another point in favour of cultivating hardwoods as recommended, is that, in tending the crop, the necessity for having to resort to pruning in extensive woods is obviated to a great extent. When the ground is stocked with a limited number of trees per acre, pruning is almost always necessary, in order to ensure a final crop of good trees. Whereas, if the ground is fully stocked with the trees which are to form the permanent crop, either as a pure wood or as a mixture, pruning will rarely be necessary after they have reached the thicket stage, because in such woods there will always be found a sufficient number of good stems. When thinning becomes necessary, great care should be exercised in conducting this operation, overthinning, in all cases, being guarded against. The first thinnings should be limited to a removal of dead and dying stems, and the succeeding ones should be conducted with the object of encouraging the development of the best stems, regardless of returns from thinnings. With regard to thinning, a practice was noticed in the treatment of oak and beech woods in France, which is well worth mentioning. In passing through a middle-aged forest near Nancy, it was very noticeable that a great many small, and what appeared to be useless beech had been left growing under the oaks, whose stems were frequently surrounded by them, and the Excursionists were informed that these had been spared purposely with the object of keeping the light off the oak-stems, and thus preventing the development of side-shoots. This plan serves the purpose well, and could be put into practice in this country with advantageous results.

In connection with the cultivation of hardwoods, the old proverb that "the exception proves the rule" holds good, as there is a possibility of having a mixture of hardwoods with conifers giving successful results. In the case of underplanting oak or other light-demanding hardwoods in localities where beech would be unmarketable, some shade-bearing species of conifer might be substituted with advantage to the financial returns, *e.g.*, if the hardwoods are very open, Douglas fir—

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on suitable soil—might be substituted. Probably the most notable example of the successful cultivation of a mixture of hardwoods and conifers is that of larch with beech, but in this case the mixture is for the benefit of the conifer and not of the hardwood.

Conclusion.

It can scarcely be expected that all readers will agree with the opinions recorded here, but it is hoped that the expression of them may be the means of causing reflection on the subject, and that it may be found that there is something to be said in favour of the statement that, generally speaking, hardwoods, or rather broad-leaved trees, should be cultivated by themselves, and conifers likewise, and not mixed one with the other.

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23. Impressions of Forestry in the Schwarzwald.

(With Two Plates.)

By J. F. ANNAND.

The writer of the following notes, having been fortunate enough, through the kind recommendations of Dr Schlich and Dr Somerville, to obtain admission to an admirable course of lectures under Herr Oberförster Philipp of Sulzburg, Baden, had subsequently the privilege of spending a part of last summer in the forest, under the tuition of that distinguished forest officer. Herr Karl Philipp's name is well known to many American foresters and British colonial forest officers, who have received much of their practical training under him. In addition to some German forestry students, the party receiving instruction last summer included two forest conservators from British colonies and the present writer. The comprehensive scheme of study taken up under Herr Philipp's guidance embraced such special subjects as methods of forest valuation, the construction of yield-tables, the preparation of working-plans, etc., but it is not proposed here to trouble the readers of the *Transactions* with minute particulars of such matters. Rather is it the writer's aim to give only such details of the silviculture, and such of his general impressions of the forestry systems practised in South Germany, as are likely to be of special interest to those concerned with the forestry problems of this country.

SYSTEMS OF SILVICULTURE.

More than a third of the whole area of the Duchy of Baden is covered with forest, largely State property, but partly owned also by communes or townships, and partly by private individuals.

The tree most largely cultivated is the silver fir, along with which there is in some regions a proportion of beech. The latter, however, in the higher altitudes, gives place to spruce.

On the lower mountain slopes, in good deep soils with a considerable proportion of lime in their composition, oak and beech are cultivated. But as the better soils are, as a rule, more profitably used for agricultural (or viticultural) rather than for forestal purposes, the area under broad-leaved species is now small, and is not likely to increase.

On the plains in the Rhine Valley, coppice and coppice-with-

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standards are still to be met with in small quantity, but these are being as rapidly as possible re-converted into high-forest.

Under all the systems practised in the high-forest of Baden, Nature does the planting or regenerating, except where large areas have been damaged by windfall, where thinnings have been neglected or mismanaged in such a way as to introduce bad soil conditions, or where the parent stems are too old to produce sufficient seed-crops to restock the ground.

In districts with very steep mountain land, one finds in the Black Forest irregular-aged crops ("femel wald"), which are managed under what is described in the English forestry text-books as the "selection" system. Of all systems this is the nearest approach to natural virgin forest. All age-classes are mixed together either as individual stems, or better, in very small groups. By this system the ground is always covered with tree-growth, and soil denudation, even in the steepest land, is entirely prevented.

The "selection" forests are usually found at altitudes of from 1000 to 3000 feet. The yield of good timber is much higher than one would at first anticipate. Measurements of numerous sample-plots have proved the current annual increment to be as high, very often, as 8 cubic metres per hectare, or about 112 cubic feet per acre.

According to Herr Philipp,[1] the growing stock in most of these irregular woods is made up of the following species, and, in *e.g.*, the valley of the Kinzig, in the following proportions:—

Silver fir, ...	60 per cent.
Spruce, ...	30 per cent.
Beech, ...	8 per cent.
Pine, ...	2 per cent.

with sometimes a little oak in the lower ground. The proportions of the different species vary, however, in different localities.

The silver fir is by far the best coniferous tree for selection crops. It endures a great amount of shade and has great recuperative power when set free after having been overshadowed and suppressed for a long period. Its wounds heal rapidly, and the damaged part does not decay as in the case of spruce.

Amongst other advantages, the silver fir has good seed-years at short intervals. It is very wind-firm, and, as regards density

[1] *Irregular Woods in the Black Forest*, by Karl Philipp—reprint from *American Forester*.

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of growing stock, it is unsurpassed by any other conifer, so that it is an excellent soil-protector.

The stems approach very near to the cylindrical, the form factor being higher than for any other coniferous species. In the Black Forest, also, silver fir is only very slightly affected by injurious insects.

From an altitude of 2000 feet and upwards the spruce gets more numerous in the mixture, and at 2500 feet, where there is greater humidity of soil and atmosphere, it is the prevailing species. The spruce is not wind-firm like the silver fir, and, owing to its liability to damage from gales, it does not lend itself so freely to natural regeneration on the flat moist ground as silver fir, but higher up in the mountains, in the rocky soils, the roots get better anchorage, and with cautious thinning, natural regeneration is not only possible but is successfully practised. In the low ground, however, the spruce is planted amongst the naturally regenerated silver firs.

The pine is not used to any extent on soils in good condition. Where it is used its growth is satisfactory in the Black Forest, and it almost equals spruce as regards shape of stem, whereas, as is pointed out by Herr Philipp, the pines in the hot valleys of the Rhine are frequently crooked. They are often thinly crowned and poor in quality, thus showing that *locality* has often a good deal to do with the fixing of the value as timber of any particular species.

Turning again to Herr Philipp's article, we find it stated that "the timber-market of the Rhine prescribes a minimum diameter without bark at breast-height, for different classes of timber, as follows:—

"Class IV., 14 centimetres at the length of 8 metres.[1]
" III., 17 " " 16 "
" II., 22 " " 18 "
" I., 30 " " 18 " "

And "the average prices during the last few years in the Black Forest were:—

"13 marks for one cubic metre of the IVth Class.
16 " " IIIrd "
18 " " IInd "
20 " " Ist " "

[1] Centimetre = about ·39 inch. Metre = 39 inches. Cubic metre = 35 cubic feet.

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According to investigations carried out by Herr Philipp, a silver fir, in order to belong to the first class, must have the following proportions (diameter measured at breast-height) :—

" A minimum diameter of 55 centimetres if 30 metres high.

" " 53 " 31 "

" " 50 " 33 "

" " 48 " 34 " "

Stems which have reached the prescribed diameter for a given height would after that only have a quantity increment, whereas those under that diameter of the same height would have not only a quantity increment but a quality increment as well, and in such cases as these the discriminating powers of the skilful forester in regard to thinning might be exercised with the most valuable results. Though apparently simple, a "selection" system, in order to obtain the best financial results, really requires more skill on the part of the forester than any other.

Theoretically no part of the forest is ever at rest—a system of felling and regenerating is going on continually all over the area, but in practice the forest is worked by compartments. Healthy growing trees are considered mature when they attain to the dimensions of Class I. stems. This financial maturity is reached between the age of 100 and 140 years, the general average rotation being 120 years.

In order to maintain proper forest conditions and keep up the irregular character of the crops, a normal growing stock has to be maintained, corresponding to the normal mean annual increment, with age-classes also normally distributed. Working-plans are renewed every ten years, when the volume of timber in each compartment of forest is measured in diameter classes, the amount of sound timber being separately reckoned from what is faulty.

Besides the regular cuttings, confined to prescribed compartments, accidental fellings—the result of snow-break, windfall, etc.—are continually taking place under good management, and these accidental fellings amount to as much as from 20 to 30 per cent. of the whole. Where there is no good system of roads, much of the accidental fall is not fully utilised.

Beech is less encouraged in the silver fir forests than formerly. Its chief use is for fuel, but as the silver fir is a sufficiently good soil-protector, the beech is less required than in woods of oak

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and pine. The cultivation of oak, however, is never attempted without the help of beech.

In every range in the Black Forest there is a proportion of "selection" woods, but the largest proportion of them are worked on the SHELTER-WOOD COMPARTMENT SYSTEM, or in some cases on a modification of this, namely, the SHELTER-WOOD STRIP SYSTEM.

The greater part of the Sulzburg range (chiefly silver fir with a little beech and a very little spruce) is worked on the shelter-wood compartment system. This method is so well known that it is not necessary to describe it in detail here.

In this range, as in most others, there are forests belonging to communes and forests belonging to the State. All these are placed under one Oberförster, who controls the working of the whole. A share of his salary is paid by the communes, who have, however, the right, under certain restrictions, of prescribing the details of the working-plans for their forests.

As has been already stated, under normal conditions Nature does the restocking, but where windfall occurs, or where there are blanks from other causes, the ground is artificially planted up without loss of time. As a matter of fact, "repair plantings" or "cultures" are, under good management, constantly going on. Formerly planting was not so much resorted to, but with the value of forest produce constantly rising, and with increasing facilities for transport in the shape of new roads in the forest, the system is really becoming more and more intense, and if Nature is not, for some reason, likely to perform the work sufficiently well and in time, planting is resorted to without hesitation. In some cases nurseries are formed on the spot, but as the ground to be planted is usually scattered in small patches over huge areas, it is a common practice for an Oberförster to purchase his planting stock direct from nurserymen.

The cost of labour, and consequently the cost of planting, is high, but as the planting has to be done only on a very small percentage of the whole area, this is of less consequence, and the forest manager can afford to make a judicious outlay in this respect. In the Sulzburg range the species most commonly used for "repair" plantings are common spruce, Sitka spruce, Douglas fir and white pine (*Pinus strobus*); occasionally larch and Scots pine are used. Very dense planting is not resorted

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to in Baden. Formerly 10,000 plants per hectare[1] were used, now 6000 is considered ample stocking; but it must be kept in mind that with the hot summers of South Germany the energy of growth in height is probably much greater than with us, so that it does not necessarily follow that what would be sufficient for South Germany would be equally so for us. It has further to be remembered that in those forests the timber of finest quality will be had from the naturally regenerated stands with a very dense young growth. Consequently it is not so highly important to have very dense artificial cultures.

The average rotation period for the silver fir worked on the shelter-wood compartment system is 120 years, and natural regeneration requires from 30 to 40 years to complete. Experience has recently proved, however, that the average age of 100 years would probably make a more profitable rotation period in the lower reaches, and the tendency now appears to be to aim at working into this rotation.

As regards actual money returns from the silver fir forests, it will readily be understood that with areas so vast and with conditions so variable in the matter of soils, altitudes, etc., the financial results must also vary. In some stands where the situation is exceptionally favourable, the net returns appear to work out as high as about £3 per acre per annum, but, excluding poor and unproductive sections at extreme heights, 30s. an acre would probably be nearer an average money return. Even this very favourable result would not be possible without very skilful management and the help of natural regeneration. It has to be kept in mind also that all timber, small and great, has a market value, while the market for high-class timber is very good indeed.

On a forest range near Baden-Baden, where the forests occur at an altitude of from 1000 to 3300 feet, the average annual increment, over 80 per cent. of the range, worked on the shelter-wood compartment system, amounts to about 92 cubic feet per acre. On the very high reaches the production is of course less, and the limit of profitable production is reached somewhere about 3000 feet.

One thing which strikes even the casual visitor from our own country is the extraordinarily successful results obtained in natural regeneration. In some of the compartments of the

[1] One hectare = 2·47 acres.

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[*Photo by J. F. A.*

NATURAL REGENERATION OF SILVER FIR (Shelter-wood Compartment System).
Dense young growth, 3 to 5 feet high.
Large proportion of "mother" trees removed.

[*Photo by J. F. A.*

ADVANCED STAGE OF NATURAL REGENERATION.
Most of "mother" trees have been removed.

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Sulzburg range, under the skilful management obtaining there, the natural regeneration is as near perfection as one could well imagine.

If the advantages and disadvantages of the "selection" system and the shelter-wood compartment system are compared, it can be claimed in favour of the former, that there is a complete protection of the soil and less liability to damage from storms. These are very important matters in high altitudes on the steep mountain sides where the system is chiefly practised. On the other hand, the "selection" system is one which requires a greater amount of skill than any other, not only on the part of the forest officer but on that of every grade in the service. Another objection to the system is that there is a greater percentage of rough branchy timber than under the shelter-wood compartment system; but this disadvantage is less pronounced when regeneration proceeds by means of small groups or hursts, in preference to that by means of individual trees, and experience in Baden has shown that the financial results are at anyrate as good as under any other system.

The shelter-wood compartment system also provides for good soil-protection, and is productive of a much larger percentage of clean timber of high technical value. There would, however, be a somewhat greater liability to damage from storms than under the "selection" system. Natural regeneration is usually very complete under this system also, and it is the preferable one at the lower altitudes where the better class soils are more abundant. When the time for regeneration comes round, if there is a mixture of beech trees in the silver fir stands, the former are cut away almost entirely, otherwise there would be too much beech in the young crop, and there would be a danger of the silver fir being suppressed unless expensive cleanings were resorted to. Two or three good beech seed trees per hectare are usually considered sufficient to leave at the seeding stage, but old suppressed beech trees not likely to produce seed are left for a time to protect the soil and the young growth. Later on, when no longer required, those suppressed beeches are cut away. By means such as these, almost perfect regeneration of the silver fir can be effected.

The oak forests do not occupy a large percentage of the whole. They occupy the lower slopes with limestone soils of better quality. Their area has been much curtailed by the

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encroachments of the vine-grower. They do not present any exceptional features of cultivation. There is usually maintained a sufficient quantity of beech to seed the ground under the oak for soil-protection, but where this condition is absent beeches removed from thickets elsewhere are planted in the open parts. This is usually done when the oaks attain the age of 40 to 50 years, and, when the undergrowth is sufficiently established to prevent the growth of epicormic shoots or "water sprouts," a regular and free system of thinning is commenced.

Modern System of Thinning practised in Baden.

One of the practices in our so-called system of forestry in Great Britain, which has deservedly met with severe criticism on the part of those who have been accustomed to the scientific methods of the Continent, is that insane one of thinning out young woods immediately they enter, or even before they have entered, the thicket stage. The practice is one which cannot be too strongly condemned where the production of commercial timber is the main object in view.

At the same time, it is just possible that in the building up of the more rational systems which are at present slowly taking shape in this country, we may err in rushing to the opposite extreme by following too rigidly what may now be described as the *old* Continental method of thinning, that is to say, the method which in practice consisted in the removing of very little more than the suppressed trees. It may not be without interest, therefore, to follow from its origin the past history of the old method of procedure, and also to examine the results as one finds them in various regions of the Black Forest, where the effects of the old method are still apparent in some regions.

In the beginning of last century pasturage by cattle and other stock was general throughout the forests of Germany. This had the effect of retarding natural regeneration. The forest would get more and more open, grasses and other weeds would have free scope for development, the quality of the forest soil would gradually become deteriorated owing to the open condition of the canopy, and ultimately the forest would become incapable of restocking itself. At anyrate, this appears to have been a common condition of matters about a century ago in the silver fir forests of Baden. By and by rights of pasturage appear

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gradually to have been bought out, and now in some States pasturage in the forest is prohibited by law.

In order to bring the soil back into fertile condition, the German forester, recognising that the openness of the canopy was the cause of the deterioration, set about remedying matters by once more introducing close order, and with a view to hastening this, the thinnings were restricted to the removal of suppressed trees. At anyrate, theoretically, this was the system adopted. Now if there had been no disease, no windfall, no insect attacks, no accidents of any sort to the standing trees composing the forest, probably this system would have had very highly satisfactory results. But unfortunately there was and is windfall, cankerous diseases are by no means rare, in particular that caused by *Æcidium elatinum*. The mistletoe also is common, and produces bad defects in the timber. The method of thinning out then took no account of dominant trees which might be affected by cankerous growths or which might have other defects. These would in course of time get broken off by the wind, and large gaps would be caused in the canopy. This system then, carried to extremes, had to a certain extent the effect of defeating the very objects for which it was chiefly intended, namely, the preservation of good soil conditions and the natural regeneration of the forest. Further, the omission to cut defective trees, such as those with wide spreading branchy crowns, if they happened to be in the dominant class, had often the effect of prejudicing the growth of probably several surrounding smaller but much finer stems.

Now, however, the younger German foresters are practically unanimous in upholding the more modern system, which, by the way, does not seem to have originated in Germany, but rather in Denmark or France. Now it is being adopted in some parts of Germany in a more thoroughly scientific manner perhaps than either in Denmark or in France. It has been given various names. It might be called the "Danish" or the "French" system or the "free thinning" system. It should not be confounded, however, with the *very free* system which had, until recently, come to be considered the correct one in Great Britain during, at least, the latter half of last century.

Thinning should properly only begin when the larger part of the height-growth has taken place; whereas under our arboricultural method even the thicket stage was never permitted to

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exist. "Free thinning" permits this, but later on takes more account of the thinning of the crowns, the best 500 or 600 stems per hectare being always favoured. Dominant *faulty* trees are freely removed. In the silver fir forests those with cankerous growths are worst. Others may be spoiled by having broken tops or frost cracks, or mistletoe growths. Others again have forked growth, or are rough branching trees with low spreading crowns — called by the Germans "wolf" trees, etc. Then again, the suppressed or overshadowed trees (other than dead or sickly ones), instead of being cut out are purposely retained, not only to protect the soil but also to retard natural regeneration until the proper time —often a very necessary precaution. Overshadowed beeches are found excellent for this purpose when they occur in mixture with the silver fir. They seldom produce any seed, and they serve the purpose of soil-protection admirably. When the proper time for natural seeding is reached they are gradually cut away.

Under the "free thinning" system, the proportion of thinnings to final yield is very much larger than it was under the old regime, and in the case of light-demanding species like the oak, the proportion may be as high as 150 per cent.

As regards total production under the two systems, the yield of timber would, at least, be as high under the new system as under the old, and the financial outcome would be much better, because the quality of timber would be better, and the forest could be worked with less locked up capital.

It is certainly due to this vigorous method of "improvement" thinnings that such excellent results in natural regeneration are obtained in various forest ranges in Baden, but the method is, of course, applicable to all forest species and under every silvicultural system.

The question is often asked, "How is it possible to carry out the felling of the mature timber during the various stages of the natural regeneration, without destroying the young growth?" The work certainly requires a large amount of skill on the part of the woodmen. But it should be remembered, in the first place, that there is no desire to grow trees of excessively large diameter. Tall, straight, cylindrical boles of sufficient but not extra large diameter are most numerous. Then, secondly, trees of the largest dimensions are always removed

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first, after the initial seeding stage is past. Thirdly, regeneration is completed and the balance of the overhead protection trees removed as speedily as possible. Nevertheless it often happens that large trees have to be felled after there is a considerable covering on the ground of fairly advanced young growth. When this is the case, the woodmen very often do a thing which seems at first sight to be the worst possible practice. They fell the old trees, not on the comparatively bare ground with few seedlings, but right into the very thickest and best of the young growth. The reason for this is that in these thickets there are perhaps 50 per cent. more young trees than are necessary for a crop, so that it is no disadvantage at all if a considerable number are destroyed. On the other hand, there may be no young trees to spare at all in the thinly stocked parts. Sometimes it is necessary to lop the branches of the heavy crowned old trees previous to felling, in order to prevent damage, but if the felling is promptly and skilfully pressed on through the various seedling stages, little harm results to young growth.

The tree cutters are very clever workmen, and they speak somewhat contemptuously of the unskilled "tree-killers" who do the felling in the plains, where the clear-felling system is practised. The tree felling is done with the axe and the saw, almost precisely in the same way as we find it done in Scotland.

Tree Diseases and Insect Enemies.

The disease of most practical importance in the silver fir forests is that causing the cankerous growths and swellings on the stems, that, namely, due to *Æcidium* (*Peridermium*) *elatinum*.

Owing to a too rigid adherence to the system of thinning, by which suppressed trees only were removed, this very objectionable disease has got a considerable hold and does a great deal of harm. Its effects are apparent in two ways. In the first place, it reduces the value of the timber, which is absolutely useless at the affected parts except for fuel; and secondly, when the cankerous growths entirely encircle the stems, the trees are constantly being broken over at the affected parts whenever gales occur. The canopy thus gets much interrupted, weeds gain an entrance, there is a loss of increment,

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and natural regeneration is interfered with. The most obvious remedy, and the most practical one, is to diligently remove affected stems in the course of the thinnings. This is now being done in the Black Forest.

The disease is quite a common one on silver fir in some parts of Ireland and in the south-west of Scotland. It used to be regarded by Scottish foresters as a "freak" growth. Another plant (not regarded quite as a true parasite) which causes defects in silver fir timber in the Black Forest, almost as bad as those produced by the *Æcidium*, is the common mistletoe (*Viscum album*). It is very prevalent, and owing to its easy distribution by birds, it is difficult to stamp out. Next to trees with cankerous growths, those having mistletoe plants on them are the most favoured for removal in the course of thinnings under the modern system.

Insect enemies are not particularly numerous, and in any case they are always kept well in hand.

Tomicus curvidens is to be found on the silver fir on dry slopes in unthinned stands where there are weakly trees. This beetle may also in course of time attack healthy trees, but it prefers weakly ones. According to Herr Philipp, there may be two or three broods in the course of a season. The remedy is to fell weakly or diseased trees, bark them and burn the rubbish. Mr Gillanders says the beetle has not been recorded in this country.

Tomicus (*Trypodendron*) *lineatum* is another beetle found in the silver fir and spruce stands. Owing to an excellent rule, strictly adhered to, which requires all coniferous trees felled and left lying in the forest to be at once barked, serious insect attacks are really non-existent.

The species of *Chermes* which attacks the silver fir in this country with such fatal results, is certainly present in the Black Forest, but the natural constitutional vigour of the trees there is such that any bad effects are not apparent.

Everybody can walk at pleasure through the roads and paths in the forest, and yet not one single instance of wilful damage, either by old or young, ever came under the observation of the writer during the whole of his stay in Baden. A line of conduct such as this must have taken time to develop like the forestry systems themselves.

How very different often is the state of matters with us!

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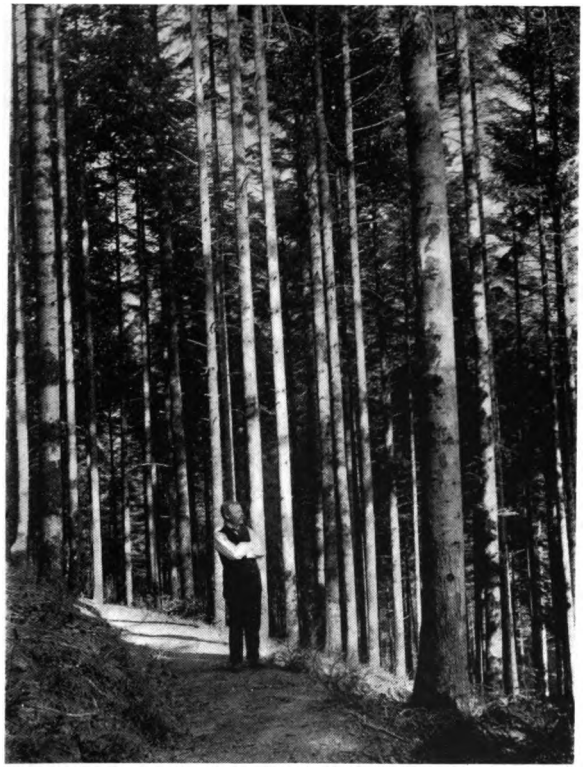
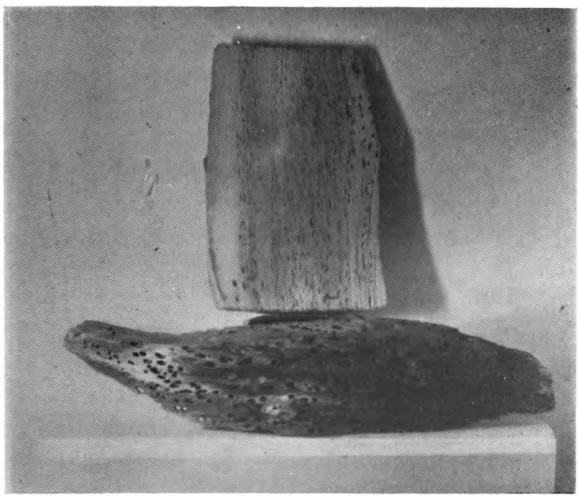


[*Photo by A. F. A.*

WELL-THINNED STAND OF SILVER FIR. Average Age, 55 Years.



[*Photo by M. J.*

PIECES OF SILVER FIR TIMBER SHOWING INJURIOUS EFFECTS OF "SINKER" ROOTS OF MISTLETOE.

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Town Water Supplies from the Forest.

Modern sewage systems and water supplies are gradually being developed in the towns and villages of the valleys and plains. All new water supplies are being taken from the forest. Generally (but not necessarily) the supply for any particular town or commune is taken from the range of forest belonging to it. These water supplies have their source where there may be said to be absolutely no contamination either from human habitations or from the grazing of live stock.

While we are still debating (somewhat senselessly, perhaps) whether or not a pure water supply could be got from forest land, the question has been settled very effectively and in a very different way in Baden. The forests have been developed first of all, and now without exception the towns look to the forest for a pure water supply.

Further, the forests themselves often provide the necessary capital for the laying down of the water supplies. As a rule, for various reasons there are large surplus stocks of standing timber in the forests, and when a commune or town requires extra money for such purposes as road construction or water supplies, it can very often be provided by means of one or more extraordinary fellings of surplus timber, and that without in any way interfering with the normal growing stock of the forest.

Road Making.

One of the many works of improvement going on in the forests at the present time is the building in some ranges of a very complete system of mountain roads. These new roads are broad, well built and thoroughly macadamised. They are made with easy gradients, and are preferred to tramways. Ultimately they will entirely displace timber slides and other somewhat primitive methods of transport in the Black Forest.

One chief result of the making of these roads is that an enhanced price can always be obtained for the timber, and they make it possible for the smaller timber merchants to penetrate farther into the forests for their supplies.

Rural Life and Forest Labour Supply.

The rate of wages for workmen is much higher in Baden than in North Germany. Forest workers earn from 4 to 5 marks

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(shillings) a day. They are, however, an extremely hard-working set of people. They walk or cycle long distances to their work, and they have much longer hours than British workmen. Most of those workmen are either small-holders themselves or they are the relatives of small-holders, and generally, but not always, they are the owners of their little farms. The average size of such a holding is about 12 acres.

In limestone soils on the slopes, the vine is one of the chief crops, and it requires a large amount of hand labour *during the summer season.* The cattle, which do a great deal of the carting work in the forest, are all stall fed. The grass is mowed for hay at least twice during a season. The farmyard manure is used chiefly for the vines, and much artificial manure is also required both for the vines and for the ordinary field and market garden crops. The system of cultivation of these holdings has therefore of necessity to be of an intensive character. There is no waste land in the sense in which we use the term. Practically every yard of soil is utilised.

Large farms are also to be met with, but they are not so numerous as the small holdings. The whole of the valleys present a charming and varied picture, made up of cultivated farms, grass meadows and vineyards. Here and there in the lower hills the oak and beech forests obtrude themselves, while higher up in the mountains, where cultivation is no longer possible, an intense system of forestry, with the silver fir as its main element, prevails. The towering mountains, the apparently irregular character of the forest, the deep valleys, the clear running streams, all add a variety and a charm to the scenery which is entirely absent in localties having what may be called a more artificial system of forestry.

Probably no patriotic Briton would willingly admit that the scenery is equal to our own, but surely not even the most fastidious lover of the beautiful in nature could take any exception, from the æsthetic point of view, to such a system of forestry as prevails in Baden.

But to return to the question of labour supply. The small-holder, living in the village or town in the valley, is very fully employed during spring and summer on his own farm or on his vineyard, but during late autumn and winter he has very little to occupy his time, and he generally turns to the forest for employment. This is an arrangement which works admirably. It

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provides the regular skilled workman, so necessary for the proper conduct of work in a forest where the operations consist so largely of *improvement* fellings, and where so much damage might be done by unskilled workmen to young growth, which must receive specially careful treatment during at least one-fourth of the whole period of the rotation. Without this abundant supply of skilled labour it would be impossible to attain to the highly successful results which one finds in the Black Forest.

On the other hand, if the small-holder does not actually depend on the forest work for his very existence, at anyrate it ameliorates his condition and provides him with a more comfortable living. The two systems have grown up together more or less, and one might say they are inseparable.

The small-holder, or the large farmer, very often also does the carrying of the timber (either with oxen or horses) from the forest to the timber merchant's saw-mills in the towns in the valleys. Many industries in the towns also depend on the forest for their existence.

Concluding Note.

In putting together the foregoing notes, the writer had no intention of suggesting that the systems of forestry practised in Baden could be adopted wholesale in this country, or that the whole of the Highlands say, or the southern uplands of Scotland, or the North of England fells, might be converted into "one horrid forest." Nor is the preposterous idea put forward that large farms could be successfully broken up in a wholesale fashion into small holdings. The economic conditions of the two countries are in many ways totally different. On the other hand, there are many points of resemblance. There is first the question of the necessary forest labour. Wages in our country are usually high, and it is a good thing they are high, but this does not make the question of planting any simpler. There is a desire for cheapness, and it is a necessary condition of profitable forestry to have the ground stocked at a cheap rate.

Workmen's wages in Baden are also high, and here again it is a good thing that they are high, and probably the position of a workman in South Germany is much better than that of a workman in North Germany.

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In Baden the labour question is settled by making nature do a large proportion of the stocking.

Artificial planting is certainly resorted to, and now more promptly, and to a much greater extent than formerly; and very extensive nursery establishments are carried on in South Germany; but if the percentage of trees planted over the whole vast area of forests in Baden were reckoned up, it would be found very small indeed. It is the large amount of natural seeding of the forest which makes it possible to carry on the very necessary artificial cultures with profit.

A large amount of labour is provided in the forest, but it is largely labour which gives a good immediate return. For example, thinnings proper (there may be cleanings before) are not commenced until a net surplus is obtainable.

The systems of forestry which obtain in Baden have taken a century and more to build up, and they are still being improved upon. It will probably take little less than a century to perfect any similar system in this country.

It is not suggested that any system built up exactly on the Baden pattern could be established here. We could not, for example, grow the silver fir, for it seems perfectly certain that we have got beyond the northern limit for the profitable growth of this tree. But there are other species which, no doubt, will be found suitable to take the place of the silver fir.

The silvicultural characters of the few forest species chiefly cultivated in Germany have been thoroughly studied and are well understood, so far as they apply to German climatic conditions. It is by no means the case that we are so thoroughly conversant with the silvicultural characters even of common suitable species, as applied to our conditions and climate, and these ought to be the subject of further investigation and study. The principles involved are, however, the same.

It seems to the writer, therefore, that when and wherever forests are to be established in this country on anything like an extensive scale, the system should be built on such a foundation as to provide first for the permanency of the forest. Species should be selected which (always assuming they are suitable timber species) could reasonably be expected to reproduce their kind from seed, naturally, to a more or less perfect extent, so as not in the future to have to depend entirely for their renewal on artificial planting. This of course could only be accomplished in

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the future, and it is to the work of the public or private nurseryman alone which we must look in the first instance. Second, a sufficient supply of skilled labour is necessary. In building up the forest, permanent provision should be made, by providing holdings or otherwise, for keeping skilled forest workers on the land.

With such objects in view, the combination of small farms and forest, as one finds it in Baden, appears worthy, to some extent at any rate, of imitation.

During a century the price of timber in Germany has risen more or less steadily at the rate of 1 per cent. per annum. That is to say, it has doubled itself in one hundred years.

The steadily rising price of timber, and its increasing scarcity all over the world, is a matter of great moment in an industrial country like our own.

So far, anything of consequence which has been done for forestry in this country has been done by private individuals. Under present conditions they could not reasonably be expected to do very much more than they are doing. The position of municipalities, up to the present, with regard to forestry has not been such as to encourage the hope that they could deal effectively with the question. It seems quite obvious, therefore, that any large scheme of forestry to be effective could best be undertaken by Government, or at anyrate should be under its help or guidance.

Will any British Government ever take up seriously the question of reforesting suitable parts of the country on a large scale?

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24. Notes of Silvicultural Interest.

By THOMAS HALL.

Overthinning of Woods.—The much-discussed method of raising forest crops by natural regeneration or direct sowing can hardly be called practicable in this country under existing circumstances, owing to the fact that most private estates are overrun by game, and more especially by the kinds most injurious to young forest crops, such as rabbits and hares.

It is easy to understand, under such circumstances, why woods are so much thinned and never underplanted with forest trees, as even the undercover usually planted in a game preserve, such as privet, laurel, and rhododendron, will not thrive under a really close canopy, such as would be formed by a crop of timber grown on purely silvicultural lines.

That undercover of this kind could be largely dispensed with in our game preserves has not as yet been realised by the majority of landed proprietors or their agents, who go on from year to year cutting down trees which in all probability would not have reached their highest value for the next fifty years, under the pretence, perhaps, that the timber is required for estate purposes, but in reality to save the undercover from being exterminated. The forester, even though he be of the new school, has to submit to the inevitable, the keeper's advice being generally considered of more value than his where game is preserved on an estate.

Underplanting Game Covers with Forest Trees.—Highwoods are rarely underplanted in this country, owing principally to the expense which would be entailed by the enclosing of woods of large extent with a fence sufficient to protect them until they would be safe from the attacks of ground game. A simple plan whereby this expense may be greatly reduced, may therefore prove of interest to many who contemplate such an undertaking.

We will suppose that a wood of 8 or 10 acres, composed principally of oak, and about seventy years old, has become bare at the bottom and useless as a game cover, and it is only the expense of protecting the whole area which hinders its underplanting.

The underplanting of the whole area may, however, be success-

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fully carried out with very little expenditure, by enclosing (with a rabbit-proof fence) say 2 acres of the most open part of the wood, and planting this with 1-2 year seedlings of spruce, silver and Douglas fir, at 2½ to 3 feet apart, 13,000 trees or more, sufficient to plant the whole area at 5 to 6 feet apart when the trees are old enough to withstand the attacks of ground game. When the trees have attained a height of 3 to 4 feet, they can be thinned out by transplanting with balls of earth attached to their roots. The pits having been previously made, the trees should be carried on hand-barrows, constructed with a frame (two-thirds the height of the trees) all round them, one end being detachable, so that the plants can be put in and taken out more easily. The frame keeps the plants in an upright position, which is of great importance, as were the plants allowed to fall over sideways, the ball of earth, being much heavier than the tree, would be broken and become detached from the root, taking with it the small fibrous roots on which the success of the operation entirely depends.

The trees should be planted in the open spaces between the old stems at 5 feet apart, the largest and strongest being left standing on the enclosed part at the same distance. It will be found an advantage to have the enclosure on the most exposed side of the plantation, so that when the final transplanting takes place the newly removed trees will have the benefit of the shelter from the firmly established ones remaining.

Woods underplanted in this manner would repay the cost if it were for nothing else than the benefit to the older trees by having their stems cleaned of side branches.[1] It would also form a better game cover, and hold pheasants better than privet, which, from its dampness, is rarely resorted to.

Regeneration of Beech by Natural Seedlings.—In a good seed-year a very simple plan for stocking a nursery break with beech may be carried out in the following manner very successfully. A piece of ground is selected, and enclosed with 1 inch mesh wire netting, under one or two good seed-bearing trees. The ground inside this enclosure is dug over roughly to a depth of several inches in September or October before the seed begins to fall. After the seed has fallen, the ground is lightly prodded on the surface, and levelled with an ordinary garden fork to

[1] To secure this object the underplanting should be done earlier, say at the ages of 30 to 50 years.—HON. ED.

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cover the seed, and finally given a light rolling to imbed the seed more firmly in the ground.

Pigeons and squirrels should be kept off during winter by shooting, else they will devour large quantities of seed which may not have been properly covered. If mice are numerous, poison should be laid in drain pipes so that other animals cannot reach it. Rats will be kept off by the 1 inch mesh netting.

When the seedlings are two years old they should be lifted with balls of earth by means of an ordinary garden trowel, and carried on hand-barrows (with a raised edge 4 inches deep all round) to the nursery, where they are laid out in lines 15 inches apart, with 4 inches between each plant.

The garden trowel is again used in this operation, the ground having been prepared to the necessary width, and the line set at 15 inches from the last row. Small holes at 4 inches apart are then cut the exact size of the ball attached to the root of the plant, the plant and ball are inserted and the earth firmed round it with the hand. No treading with the foot is allowed, as this would break the ball of earth round the plant and otherwise injure the roots.

The great advantage of this method is that the young seedlings have the shelter of the parent tree for the first two years, which of course would be denied them if the seed were gathered in the usual way and sown in the nursery beds.

Preventing Frost Lifting in Seed-Beds.—Sowing tree seeds in rows instead of broadcast has lately come more into practice in the nursery, and although this in itself is some protection against frost lifting, it may be found necessary, in some localities, to give the young seedlings some artificial protection for the winter months. I discovered the beneficial effects of mulching or bedding between the rows by accident two years ago. The leaves from a beech tree, which were shed over the wall into the nursery, got drifted by the wind into a sheltered corner where four beds of Menzies' spruce were sown. Two of the beds were covered with the leaves, and owing to pressure of other work at the time they were not removed. The result was that the other two beds were lifted by a black frost in February, and they had all to be gone over and pricked in again, and the ground firmed about them, while not a plant was stirred in the two beds covered by the leaves.

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I have since then found it much better to bed between the rows with spruce needles, as they are not readily shifted by wind, and do not require to be raked off in the spring. Leaving them on the bed keeps down weeds, and reduces the danger of drought to a minimum.

Mulching to prevent Sunbaking and save Watering.—Mulching seed-beds with moss or cut grass to prevent sunbaking, and to save watering, especially where a large quantity of seed is sown, has been the practice of many foresters for a number of years, but great care must be taken when this material is used in removing it when the young plants come above ground, as much injury may be done to their tender heads, by tearing away the seed casing, before it has dropped off in the natural way.

A much simpler plan, and one that will be found to answer the purpose quite as well, is to cut spruce boughs with healthy green foliage, where they can be spared, and lay them on the beds with their butt ends stuck in the paths between the beds. When the seed germinates, the inner ends of the boughs should be raised and propped up with a forked twig stuck in the bed between the rows of seeds. An occasional watering over the boughs keeps the beds nice and cool, and the ground will never get crusted, as would be the case with continual watering without any protection. Mulching between the rows of transplants will also be found beneficial to their growth, and, what is of more importance, to the formation of fibrous roots. A good dressing of half-rotten leaf mould between the rows will answer this purpose best, and this should be kept continually stirred with the hoe along with a portion of the surface soil. The fine particles of soil and mould will keep the moisture always near the surface.

(*To be continued.*)

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25. Continental Notes—Germany.

By BERT. RIBBENTROP, C.I.E.

At present, when the training of foresters in England has become a national and imperial question, it may probably interest your readers to know what is happening in this respect in Germany, where a controversy regarding the education and training of officers for the higher grades of the forest services has, throughout the past year, excited considerable interest in professional circles. The contending parties agree that a prolonged course of practical forest work, in addition to mere excursions, must, at one period or other, form an essential part of the training; but whereas one of the opposing parties advocates an entire university education, the other is in favour of retaining the instruction in sciences and technical subjects at the existing forest academies, to be preceded by a year's lectures at a university in political economy, law, and other subjects not so fully taught at the technical high schools.

In the beginning of 1907 the fight threatened to become a heated one. A number of letters, professedly from Prussia, till now considered the stronghold of the forest-academical party, had appeared in the *Forst und Jagd Zeitung* and in some other of the newer technical publications, criticising the existing departmental education at the forest high schools, and calling for radical changes. The letters were anonymous, and eventually led to a very angry retort in the interest of Eberswalde. However, the heat evaporated, and all further discussions were conducted with the dignity that the importance of the subject demands.

The first official meeting of the rival parties took place in Berlin during the twelfth sitting of the Council of Forest Management (Forst-Wirthschaft-Rath) in February 1907. The meeting was attended by forty-five official members of the committee, drawn from all parts of Germany, and by special delegates deputed by the State forest administrations of Prussia and most of the other important States of the empire, clearly indicating that the question under discussion was considered to be one of vital importance.

The leaders of the rival camps were Professor Dr Enders

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(Munich) and Oberforstmeister Riebel (Munden). The theses of the former were :—

1. The forest academies, in their present condition as isolated technical schools of forestry, can no longer be considered to be suitable educational institutes for probationers of the upper forest services.

2. At least half of the practical business of an officer in the upper grades of the forest department consists of purely administrative affairs, which demand a thorough knowledge of law, land revenue, political economy, etc., and this alone would be sufficient reason for an amalgamation of forest education with university teaching. There are, however, other reasons which render this necessary. (*a*) The scientific and social intercourse, with professors and scholars of other scientific professions, forms both for the teachers and the probationers of the forest service, a rich source of new impressions, stimulates to new exertions, serves to widen their intellectual field of perception, and prevents the growth of professional one-sidedness. (*b*) A university offers the teacher ample and suitable means for original research, and gives the students opportunities of acquiring knowledge beyond and above that strictly required by their profession. (*c*) A complete social and official equality between the higher forest officials and similar officers of other departments can only be attained if the standard of education and training is equal in every respect.

3. The university course should extend over four years.

4. The utility of an initial practical course, preceding the teaching at a university, is out of proportion to the time thus consumed.

5. The combination of forest education with agricultural academies is indefensible.

6. It is very desirable that the number of universities in which forest science is to be taught should not exceed three to four for the whole empire.

The leader of the forest high school party, Mr Riebel (Munden), late director at Eberswalde, opposed in the following terms :—

1. The necessity for transferring the higher forestry education exclusively to universities cannot be admitted. It is more to the point to teach the auxiliary sciences on which forestry is based, and forest science itself, at technical high schools,

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which have been specially constituted for this purpose, and which are, moreover, intimately connected with forests available for purposes of instruction.

2. Sufficient means for original scientific research should be placed at the disposal of the professors of such academies, and their grading and pay should be made proportionate to their positions. Special steps should be taken as regards the training of future teachers.

3. In the advanced state of science, a minimum of four years' study is required for an education sufficient for the demands of the present time. Three of these four years should be devoted to studies at a technical high school.

The complete course of training, Riebel proposes to regulate in the following manner:—(*a*) Preliminary—A certificate of having passed the final examination from a classical or modern school of the first class. (*b*) A winter half year of practical apprenticeship, during which a diary has to be kept. (*c*) A year at a university—law, land revenue, general administration, political economy, finance, and history of administration to be compulsory subjects. (*d*) One year military service. (*b*, *c*, and *d* may be arranged in any sequence desired, but must be completed previously to the course at the technical high school.) (*e*) Three years' study at the high school, including the first or scientific examination. This examination is conducted in two parts: the first, taken at the end of the third or fourth half year, embraces auxiliary science, law, and theoretical and practical administration; the second part, taken at the end of the academical studies, includes surveying, all branches of technical forest science, and forest policy. Comprehensive independent work is to be demanded in this section of the scientific examination, and the examiners are to be the academical professors. (*f*) Two years practical work in the duties of the executive staff, the administrative staff, and on working-plans. (*g*) Final examination (*Staats-Examen*).

The speeches of the two eminent leaders, based on their respective theses, were followed by an animated discussion, and it became at once evident, that even in Prussia opinion —not excluding that of many present and former teachers at high schools—leaned strongly towards a university education. However, no formal resolutions were submitted at the first reading.

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At the next sitting of the Council, which took place in Strassburg in September 1907, Dr Enders (Munich) submitted his theses No. 1 and 2 as a resolution. Mr Riebel (Munden) opposed, and recommended that no resolution whatever should be put, because the question of forest education was not a national one. It had no effect beyond the boundaries of each individual State, and was therefore one which each government had to decide for itself; a resolution passed by a general German forest committee could consequently have no practical result. The directors of three other high schools also spoke in favour of the retention of high schools, and desired a declaration to the effect that none of the existing methods of forest education could be considered as unjustifiable. The high school party had, however, but few friends beside their directorial champions, and the following amendment to the original proposal was finally accepted:—"The entire higher forest education should be given at a university, and should be arranged for a minimum period of four years."

On the following day the subject was once more brought up before the general German Forest Conference, also assembled at Strassburg. An attempt was made to interest the profession in a proposal to raise the standard of the technical schools, so as to render them entirely independent of university teaching. The proposal, however, collapsed when it was pointed out that this would only mean the creation of new small universities, unable to compete with the existing large scientific centres. In conclusion, the resolution, as accepted by the Forest Council, was approved by a great majority. This is how the question of higher forest education stands at present in Germany. It is evident that professional opinion is, even in Prussia, almost entirely in favour of an exclusive university education. The position the various governments will take in regard to this problem lies, however, on the knees of the gods, and the extremely diplomatic statement made by a high official, delegated by the Prussian Government, sheds but a scanty light on the question.

It is to be noted that all parties agree that instruction forests in the immediate vicinity of centres of instruction, so to say for daily use, are essential, but that they need not be school forests, such as are attached to the Prussian academies.[1]

[1] This statement may be noted in connection with practical instruction in Scotland.—HON. ED.

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Since writing the above we find that the Prussian Government have, by a preliminary resolution, settled the question for the time being, by raising the length of the theoretical course at the academies from two years to three. A year's study at a university follows as before. So something tangible has been gained by the agitation, and the end is not yet.

The Prussian academies are justly proud of their school forests. Germany contains many other forests fully as well managed, and, from a silvicultural point of view, perhaps even more instructive, than the plains forests of Eberswalde; but none have, we venture to think, such a complete and detailed record of their management and of the gradual growth of their working-plans. These records represent a typical example of the working-plan development in Prussia, and are therefore doubly interesting. They were originally compiled for the St Louis Exhibition, and published in the form of a popular pamphlet. They are now re-edited, for professional foresters, in the *Forst und Jagd Zeitung*.

It is not generally known that Frederic the Great took a personal interest in forest management. Even before the Seven Years' War he asked for a survey of the Prussian forests, and a settled policy as regards their treatment. In 1764 he ordered, in a personal resolution, the division of every forest into 70 sections, and the gradual abandonment of selection fellings.

The first survey of the present school forest, at the time known as the Biesenthal Forest, was begun in 1755, but war intervened, and the maps were not finished till 1769. The forest was divided into 70 equal compartments, to be worked in annual sequence. The forest was then in a bad state owing to years of spoliation by rightholders and thieves, and it was evident that a literal adherence to the royal order spelt ruin. To meet the difficulty, each block containing 70 compartments was divided into two parts, each containing 70 sections, half the size of the original ones. This, with the prescription that no forest which had not already attained the age of 70 years was to be worked during the first period of 70 years, would have secured a 140 years' rotation; but during the king's life-time the subterfuge failed, and till 1786 the forest had to yield 10,000 to 20,000 cubic metres per annum.

However, though the provisions, so cleverly thought out, had no effect till 1786, they saved the situation during the revision

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which took place in 1787. An elaborated method, known as Hennert's system, was introduced, but proved to be of no practical value, and deserves no further description. As a matter of fact, it provided in itself no security for continuity, and when the period check was applied, the output became obviously too small. The revision resulted in a compromise, under which the previous output was reduced by 50 per cent.; Hennert's method thus became a system based on volume, pure and simple.

Remarkable progress was made during the next decennium: the maps produced in 1795-96 contained for the first time not only the local distribution of species, but of age-classes as well. Nobody but a practical forester can realise the difficulties and tedious labour involved in the production of this the first analytical map of a forest, till then worked by an irregular selection.

It was a splendid achievement, and marked the change from a general to an individual forest treatment. The special summary of the composition of the existing forest was elaborated with the same care, the estimated cubic contents of the various species being separated, even as regards quality. The rotation was reduced to 120 years, and the annual output was fixed at a still lower figure. Volume continued to be the basis of the working-plan.

The next periodical revision took place in 1818. Both maps and proposals are, at present, considered to have been of a somewhat retrogressive character. Though doubtless the differentiation of soils, species, age-classes, etc., can be too detailed, and become an obstacle rather than a help to a sufficiently broad treatment, the revision of 1818 went too far, and demanded, in order to secure equality within whole compartments, sacrifices in the felling age which were not justifiable. The proposals were at once considerably modified, but the principle of securing such equality at some sacrifice has been maintained till quite recent times. It may be harmless in forests situated like those in Eberswalde, but on more exposed areas other methods must surely prevail. A considerable accumulation of mature and maturing wood was found to exist, thanks to the extremely conservative working since 1786; but, on the other hand, an insect attack of some magnitude had lowered the productive value of the older Scots pine forests. Ever since 1798, all regeneration had been assisted by artificial

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cultivation on a large scale, and the younger forests were described as very fine. During the revision of 1818, the first practical foundation was laid to the present financial theory, by reducing the rotation of the Scots pine on bad soil. The income in 1818 amounted to about £1500.

The revision was still based on volume (Hartig's method); the output was raised by nearly 40 per cent., and as gradual growth of the yield was foreseen, it was provided that any surplus above the average estimate might be utilised. These accumulations amounted during the next twelve years to about 20 per cent. of the original estimate, and fears were entertained that the forest might be worked above its constant productiveness. An intermediate revision was therefore ordered in 1831. This was to be based on the summary of average increments, a method which, at that time, had taken the fancy of the authorities, and was employed in all Prussian State forests, under the name "Superficielle." The annual output was again reduced to the original estimate of 1818, and this was maintained till 1838. The next regular revision took place in 1838-39, and was this time based on a combination of volume and area. The annual output was again slightly reduced for a time, because the area of fully ripe forest then in evidence seemed insufficient. The next regular revision of 1858-59 moved on the same lines as the last one; the annual outturn was not increased, because it was at that time considered to be the duty of the State to grow timber of large dimensions, even at a sacrifice of money. The forest school at Eberswalde was founded in 1830, and the maps produced with the revision of 1850 were based on detail surveys made by the academy.

The next regular revision of the working-plan (1878-79) was conducted by Dr Dankelmann, the then director of the academy, and Oberförster-Candidate Riebel, a future director. This revision was marked by far-reaching changes.

The administrative management of the Biesenthal Forest had, in consequence of the increasing intensity of the treatment of individual areas, outgrown the capacity of one officer, and the forest was therefore split up into two divisions (Eberswalde and Biesenthal). The forest, with the exception of certain areas in the vicinity of the academy, was divided into regular high-forest blocks, each being subdivided into 120 compartments, of, as far as conditions of soil, forest growth, etc., permitted, equal

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sizes. The area check, originally introduced by Frederic the Great, was once more accepted as the simplest and safest basis for the forest management of the future, after four other more or less complicated methods had been experimented with for ninety years. The material available in the compartments falling into the first period of twenty years was ascertained, and it was prescribed that the annual exploitation should not exceed one-twentieth of such amount. This, however, was and is subject to the general prescription, that any accumulation of surplus material found to exist at the end of three years may be felled. It was further laid down, that thinnings were to return over the same area every ten years. The excised areas, near Eberswalde, were divided into three sections, to be known as the Park-blocks; they were divided into 10 compartments each, one of which was to be exploited each year under a selection treatment, with a felling age estimated at 120 years. This treatment was adopted partly in order to have a forest area available for independent experiments, trials with exotics, and for educational purposes, partly to beautify the surroundings of the forest school. These Park-blocks, originally a mixed forest of Scots pine and beech, contain now a large variety of different species. The preliminary work in connection with this revision was, for purposes of instruction, carried out in a, for ordinary purposes, unnecessarily detailed and complicated manner.

In 1888 a short control revision took place, but no changes were made. The periodical revision of 1898 showed again that no changes were required in the management of the Biesenthal division. In the Eberswalde division, however, considerable areas of Scots pine, planted on old fields, had been attacked by *Polymorphus annosus*, and had died at an age of from 50 to 60 years. This necessitated a rearrangement. The attacked areas had, for the time at least, to be treated by selection, and were for this purpose formed into four special blocks.

The total outturn from Eberswalde alone now amounts to some 18,500 cubic metres, and the net annual income to nearly £2 per hectare. The gross income of the whole area comprised in the old Bisenthal forest has risen from £1500 in 1818 to £18,000 in 1906.

Many, and often serious and costly, disappointments have so far attended the attempts to afforest old farmlands, heather areas

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and other wastes in the north of Germany, but the Prussian Government have in no way relaxed their efforts to re-establish forests where forests once existed. The question is doubtless surrounded by considerable difficulties, many of which were not recognised when the discussion arose in the middle of last century in regard to the afforestation of low-grade farmlands and inferior pastures, or were under-estimated and not sufficiently studied.

Little by little it is discovered that similar failures in the afforestation with Scots pine were observed here and there soon after the Thirty Years' War, but of course no regular records were kept.

One of the most interesting problems of the present time is the afforestation of the extensive waste lands in the old Polish provinces. The forests which once existed in these parts were devastated under the Polish régime by fire and axe; large areas were burned down to create new pastures, and timber was considered common property. Even the Prussian Government alienated, in time of wars and scarcity, large areas of State forests by sale, and finally sacrificed others, when money was scarce, in order to free the remnant from rights of user.

During the last thirty years, however, efforts were made to reacquire these wastes for afforestation, and some 100,000 acres were bought in West Prussia alone. The soil is chiefly a somewhat poor, fine sand. Up to 1906 nearly 40,000 acres had been cultivated, partly by sowing, partly by planting, but unfortunately almost entirely with pure Scots pine. A large number of young plants were dug up in various localities, with the whole root system, and placed before the Forest Conference at Dantzig in 1906, in order to show the influence of the various methods of culture.

The root development was, in every instance, confined to the surface soil, and was therefore an abnormal one for Scots pine. A root disease was not observed, and any shortcoming was ascribed to severe competition amongst the wide-spreading side-roots. A serious opening out of a thirty years old afforestation with Scots pine on old farmlands was, however, noticed in the same vicinity, a sure sign that some serious disease must have established itself; though its existence was not recognised at the time.

The afforestation of dunes forms another important part of

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the general afforestation scheme in the north-east of Prussia; and one of the most interesting of the numerous works carried out in this direction is probably the reclamation of the wind- and sand-swept land-tongue (known as the "Frische. Nehrung") which separates the Baltic from the bay to the east of Dantzig.

At one time the whole of this peninsula, about fifty miles long, was covered with a mixed forest, and contained several flourishing villages. Its disforestation began during the Thirty Years' War, and was completed in the beginning of the nineteenth century. Dunes took the place of the forest, and all life was gradually covered by moving sands, which have encroached on the bay itself at the rate of some 12 feet per annum, threatening the very existence of this important waterway. Towards the end of last century the State bought the "Frische Nehrung" from its former owners, the town of Dantzig, who all this time had done practically nothing to mend matters, and in 1890 a beginning was made with a systematic reclamation of the peninsula, both from the sea and bay side. Numerous stone spurs were built on the inner side, and plantations of willows and reeds were established between them. An alluvium is rapidly forming, and was some 20 feet broad in 1906.

The defence on the sea-side was begun with the establishment of an outer dune, a protection wall preventing the waves from reaching the foot of the natural dunes. Several parallel lines of bushy hurdles, with intervals of some 6 feet between them, were firmly planted in a continuous stretch about 100 feet from the foot of the natural dune formation. These intervals soon sanded up, and the sand-wall thus formed was again surmounted by further parallel lines of hurdles, which raised the wall in a very short time to the desired height.

The work was started in early spring and continued to autumn, when the wall was planted with *Ammophila arundinacea* and *Elymus arenarius*. The establishment and fixation of such an outwork takes two years.

When protection was thus secured against any fresh attacks from the rear, the treatment of the moving dunes was started. The head of these dunes was levelled down, and the sand smoothed to a certain extent, and protected against the wind by a network of fir branches stuck into the ground. In autumn plant-holes were made 3 feet apart, and filled with dredgings from the bay, a loamy silt, rich in humus. It is indispensable that

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this should be done in autumn, as the silt must be exposed to a winter frost. The actual planting took place in spring following, the intervals between the plants being protected by bushes and reeds.

Naturally an afforestation of this sort is expensive, and hardly to be undertaken where no other interests exist but the production of wood. The estimate for the "Frische Nehrung" alone amounts to nearly £100,000, spread over thirty years. The planting material used in the afforestation consists almost entirely of one-year-old Scots pine plants. In some places, where old soil cropped out, oak has done well.

Similar reclamation works are going on in many places along the coast, but where less money is available than is required for such intensive working as that on the "Frische Nehrung," cultivation is started with *Pinus uncinata*, a variety of *P. montana*, which covers and protects the ground much earlier and more effectively than Scots pine, but which grows more slowly afterwards and yields less produce.

The amount spent on cultural operations in the Prussian State forests has again been raised by 1,591,500 marks (about £79,000) in the budget for 1908, and now amounts to 6,842,000 marks (about £342,000). In the other German States a considerable increase has also taken place of late years in the amount dedicated to the future in the shape of cultural forest operations. Austria is proceeding vigorously with the afforestation of the Karst, an undertaking of great difficulty owing to the scarcity of water, which rushes down the denuded hill-sides. The regulation of the water supply represents here, as in the French Alps, the main difficulty. It is only the richest country in the world which hesitates to put its hand into its pocket for posterity, though it would have all the advantage of the experience gained by other countries, and often dearly bought.

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26. The Selection and Training of Probationers for the Imperial Forest Service of India.[1]

By J. NISBET, D.Œc., formerly Conservator of Forests, Burma.

I am of opinion that with the forestry, mainly Continental or its direct offshoot, now taught at several universities and at most agricultural colleges, the Forest Department could satisfactorily and quite as easily be recruited with fairly well-equipped students of estate (including woodland) management, as is found to be the case for the recruitment of the Public Works, the Educational, and other scientific departments, under a system of selection from among properly qualified candidates. But at the same time I think it is very desirable, from more than one point of view, that Indian Forest probationers should be selected by a competitive examination held by the Civil Service Commissioners in Forestry and the cognate sciences, and then be given one year's specialised training in Indian Forestry, Indian vernacular languages, and one branch of science at Oxford and Cambridge, combined with extensive tours in such European forests as may be specially instructive from the Indian point of view.

Such an examination should supply not only the Indian Forest requirements, but also all the growing Colonial needs. The Malay States, Ceylon, Cape Colony, Natal, Nigeria, the Gold Coast, the East African Protectorate, Egypt, and Cyprus now all require forest officers; and it can only be a question of time before Canada, Australia, and New Zealand must also introduce some rational system of Forest Conservation based on our Indian experience, and will then require a large number of men. And all Colonial systems of forestry must be based on the Indian system, not on European models.

Such a test would, I feel convinced, secure the best men, who are likely to be attracted by the pay and pension offered by the Indian Forest Service, after having gone through a university or other collegiate course with a view to adopting the profession of land agency or estate management. And just as open competitive examinations are now held annually in July for the Home, Indian, and Colonial Civil Services, so, too, should a competitive examination in forestry apply simul-

[1] Extracted from an article in *The Calcutta Review*.

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taneously to the selection of probationers for the Indian and Colonial Forest Services. The examination should be open to all those between 20 and 23 years of age who have obtained either—

(1) The B.Sc. degree in Forestry from Edinburgh University, the Armstrong College, Newcastle-on-Tyne, or the University of North Wales, Bangor; or
(2) The Diploma in Forestry at Oxford[1] or Cambridge; or
(3) The Diploma of one of the Agricultural Colleges at Cirencester, Downton, Aspatria, or Wye; or
(4) The Diploma of Professional Associate of the Surveyors' Institution, London.

Such competitive examination should take place in the following subjects:—

Obligatory Subjects.			
I. Forestry.	Marks.	II. Cognate Sciences.	Marks.
1. Silviculture, . . .	600	1. Geology and Mineralogy,	400
2. Management and Valuation, . . .	600	2. Chemistry (chiefly Organic),	400
3. Protection, . . .	600	3. Botany, ...	400
4. Utilisation, . . .	600	4. Zoology, . . .	400
		5. Surveying and Elementary Engineering,	400
Optional Subjects.			
French Conversation, .	200	German Conversation, .	200

. . . . . .

The training of probationers after the competitive examination in forestry and the cognate sciences should therefore not exceed twelve months, as in the case of the Civil Service probationers; and it should be specialised to meet Indian requirements so far as possible. Also it should be given both at Oxford and at

[1] To supply qualified students Oxford would then require to provide its own forestry instruction—just as Cambridge, Edinburgh, and the other Universities do—without special India Office support.

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Cambridge, as might easily be arranged through the Boards of Indian Studies without further cost to the Government of India than is at present incurred in the "Delegation of Forestry Students" to Oxford, one Professor of Indian Forestry (and Adviser to India Office) being henceforth delegated to Oxford with a salary of £700 a year, and another to Cambridge with a salary of £500 a year. The specialised course should then embrace the following curriculum (the probationers being previously assigned to provinces, as is the case with Civil Service probationers), after which the selection and the seniority of candidates should be determined by an examination in the subjects of study, to be held annually in June, on the completion of the academic year at Oxford and Cambridge :—

	Marks.
I. *Indian Forestry* (the lectures being freely illustrated with limelight illustrations)—	
1. History of Indian Forest Department; Silviculture, Management, Protection, and Utilisation, as practised in the various provinces of India, . . .	400
2. Indian Forest Code of Procedure, Office Work, and Accounts, ...	400
3. Indian Forest Law (India, Madras, and Burma Forest Acts), and the Rules and Regulations issued thereunder, .	400
II. *Vernacular Languages*—	
1. Hindustani (colloquial and elementary, in Persian character only), ...	400
2. Chief Vernacular Language of the Province to which the Probationer is assigned (including the Nagari character, and also a more advanced study where Hindustani alone is prescribed), ...	400
III. *Cognate Sciences*, not more than one of the following subjects:—	
1. Botany, ...	400
(1) Plant Physiology, or . . .	
(2) Fungoid Diseases of Forest Trees, . . .	
2. Zoology; Forest Entomology, ...	
3. Chemistry of Soil and Plant, ...	
4. Physical Geography and Meteorology, . . .	

Selected candidates who pass this examination and are otherwise favourably reported on should be appointed to the Indian Forest Service, and should receive (like the Civil Service probationers) a grant of £150 for the year of probation, with passage-money of £37, 10s. to Bombay, Madras,

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or Calcutta, and £43 to Rangoon. And seniority in the service should be given according to the results of this final examination.

During the Easter vacation at the University the probationers should be taken, at Government expense, for a tour in the Alpes Maritimes, the Pyrenees, and Gascony; and after the final examination, the selected candidates should, in July and August, be taken to visit the forests of the Vosges, the Black Forest, the forests of the Bavarian plateau and the Bavarian Alps, the Swiss mountain forests, and the spruce, beech, oak, and pine forests of Hanover,—these being undoubtedly the European woodlands that are by far the most instructive to the Indian forester.

If, after their year of probation, selected candidates appointed to the Indian Forest Service could conveniently, immediately on their arrival in India in November, be taken from Dehra for an extensive tour in the lower Tiri-Gharwal, Kamaon (Himalayan) and Siwalik forests and in Oudh, it would certainly be very useful in introducing them to practical work in India, in accustoming them to camp life, and in getting them into touch with their new surroundings under the most favourable circumstances. And even if such a tour only lasted for about four or five weeks, say from about 15th November till near Christmas, it would help to prepare the young officers for entering on their duties in the New Year with a far better knowledge of, and preparation for, them than were ever enjoyed by their predecessors, the men who have, during these last forty years, made the Forest Department a well-organised and efficient branch of our Administration in India.

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27. The Larch Shoot Moth[1] (*Argyresthia* (*Tinea*) *laevigatella*).

(*With Plate.*)

By R. Stewart MacDougall, M.A., D.Sc.

Still another enemy of the larch in Britain falls to be recorded in the tiny moth, *Argyresthia laevigatella*. This moth is not to be found in the British lists. Professor Somerville, in sending me some material showing the work of the caterpillar, in the month of May, wrote: "This is a very serious enemy in the neighbourhood of Oxford, and, I believe, has not hitherto been recorded in Britain." From this material I bred out five moths. I have also received from Colonel Bailey examples of the damage done by the caterpillars in Bagley Woods, Oxford. Professor Somerville records, in the *Quarterly Journal of Forestry*,[2] that in the district round Oxford larches up to twenty years of age have been much injured during the past autumn and spring; and in the same number of the *Quarterly Journal of Forestry*, Mr John Bennet records the caterpillars as destructive on young larch near Basingtoke in Hampshire.

Argyresthia laevigatella is one of the *Micro-Lepidoptera*, some of which, belonging to the genera *Retinia*, *Tortrix*, and *Coleophora*, are already well known as harmful forest insects very troublesome to combat. It belongs to the family *Tineidæ* and the genus *Argyresthia*. Of this genus there are more than twenty recorded species in Britain. Generally it may be said that *Argyresthia* caterpillars feed in buds, shoots, or fruits. Amongst trees, one or other species of *Argyresthia* has been found infesting birch, alder, hazel, oak, beech, goat willow, horse-chestnut, apple, cherry, sloe, juniper, and now to these in Britain we must add the species on larch.

A. laevigatella must be considered a very harmful enemy, both because it attacks young larches and because a single caterpillar is able to accomplish the destruction of a whole year's shoot.

[1] Reproduced from the *Journal of the Board of Agriculture* for October 1907, by kind permission of the Controller of His Majesty's Stationery Office.

[2] *Quarterly Journal of Forestry*, vol. i., No. 3, July 1907.

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Description of Insect.

Moth.—The moth is very small, measuring only 4 to 5 millimetres (less than one-fifth of an inch) in length and 10 to 12 millimetres in spread of wings. The forewings are silver-grey and silky, with a gloss like lead; the fore-edges are somewhat darker; the fringes of these forewings are grey or brownish-grey.

The hind wings are dark grey and not so glossy. The face is white; the base of the antennæ is white, and the rest of the antennæ dark and light-ringed. There is a tuft of hairs on the head; the colour of the hair is given differently by different Continental authorities, in my own specimens the colour is yellow. The abdomen of the moth is dark grey.

Caterpillar.—The larva is pale yellow when young, but later is pale grey, with a dash of red,[1] and is dark striped towards the hind end of the back. The head and the three front pairs of legs are black. The length is 6 to 7 millimetres.

Pupa.—The pupa is dark brown, with a black head; its hind end is distinctly pointed.

Distribution.—The moth is native to Eastern Germany, the Alps, and Holland.

Life-History.—The moths issue, through an already prepared flight-hole in the twig, at the end of May and the first part of June. The eggs are laid then on the lower part of the shoot of the year, one egg being laid for each shoot chosen. The egg soon hatches. At the time the caterpillar hatches out and starts feeding, by boring below the epidermis, the new larch branch is still developing, and the feeding of the caterpillar at this early stage is not sufficient to prevent the shoot reaching its normal length. As the year goes on, the damage is greater, owing to the increased size of the caterpillar and its more extended feeding. Winter overtakes the caterpillar before it is full grown, and hibernation takes place in the boring it has made. The borings or galleries are partly filled with black excrement and bore-meal.

In late March or in the month of April the caterpillar starts feeding again, destroying right to the wood and ringing the shoot to an extent—in the longitudinal direction—of four-fifths of an inch. The twig dies above this place of ringing.

The caterpillar is full-fed in May, and previous to its pupation

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FIG. 1.—The Larch Shoot Moth.

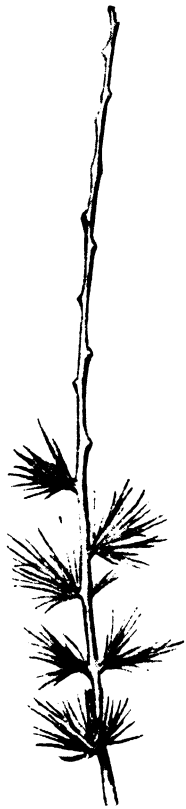
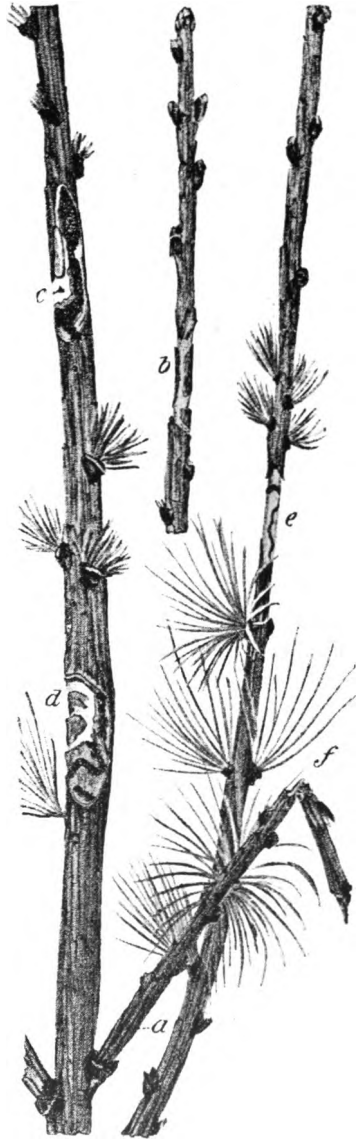


FIG. 2.—Larch Shoot (half natural size), with upper portion dead as result of infestation.



LARCH SHOOTS ATTACKED BY CATERPILLAR.

(*a*) Place of entry of young Caterpillar; (*b*) the work of the Caterpillar; (*c*, *d*, *e*) the borings made by the Caterpillar, causing the death of the twig; (*f*) shoot broken by wind at place of attack (after Eckstein, slightly reduced).

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it bites a hole through the bark that will serve as a place of exit for the adult moth when pupation is over. This flight-hole is very small. After making the hole the larva spins a light web, which covers over the little hole and pupates. The moths issue in May and June—my own specimens issued early in June.

The empty pupal covering does not, as is the case with some moths whose caterpillars are branch-borers, show itself projecting from the flight-hole, but the moth itself when ready works or pushes its way through the web covering the flight-hole, and so to the outside.

Result of Damage and Signs of Attack.—In the spring of the second year the attacked shoot fails to develop its buds, and remains brown and withered and without needles. Occasionally the dwarf shoot just above the flight-hole may produce undersized needles. As the shoot is most markedly eaten in the neighbourhood of the flight-hole, breaking takes place here easily, and these broken, bent-over shoots mark the infestation.

Treatment.—The treatment that follows from a review of the life-history is to break off the shoots and destroy them before the escape of the moths. Unfortunately no outflow of resin or appearance of excrement at the exterior is noticeable at the place of infestation (marks which in other insect enemies of trees serve to call timely attention to the fact that they are at work), and the first sign that anything is wrong may only be observed after the moth has flown. Where the moth has already been at work the damage may be expected to repeat itself, and this suggests special observation.

It will be interesting, now that attention has been directed to this moth, to find to what extent it has obtained a footing in Britain.

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28. Underplanting.

By Lieut.-Colonel F. BAILEY.

When a young crop of trees of any species has completely closed in over the ground, it will, provided it be of proper density, afford effectual shelter to the soil, conserving moisture, yielding some humus, and keeping down noxious weed growth. But a time comes when the individual trees of such a crop demand more room. The more vigorous of them then begin to crowd out their weaker associates, with the result that the number of healthy stems becomes so much lessened that the density of the canopy formed by the mass of crowns is impaired, and, in the case of light-crowned species, the sun's rays penetrate to the humus layer, while air currents sweep over the soil. Evidence of this is soon afforded by the springing up of grass and other light-loving weeds. Later on, when "thinning out" has proceeded farther, brackens, heather, whins, broom, or other herbs and shrubs appear; and the layer of decaying vegetable matter on the ground, which is essential to the continued prosperity of the crop, becoming too rapidly oxidised, ultimately disappears. But before this advanced stage has been reached, careful observation, supported by accurate periodic measurements, would have demonstrated that the rate of growth of the remaining, and apparently still healthy, trees had begun to fall off; and the deterioration of the stock may be carried to a disastrous extent.

All species do not behave identically in this matter, those which suffer most under the natural process of "thinning out" being the species which carry light, shallow crowns, like the oak, the ash, the larch, and the Scots pine. These species begin to "thin out" earlier than do those having deep, dense crowns, like the spruce, the beech, and the silver fir. The following are the approximate ages at which the process described may be expected to commence:—

Larch, ...	15-20 years.
Scots pine, ...	20-40 ,,
Oak, ...	40-60 ,,

One way of dealing with the difficulty is to cut down the crop before serious injury to the soil has resulted; but larch, Scots pine, and oak do not attain the dimensions which are

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usually most profitable at the above ages, and consequently the crop cannot, generally speaking, be so dealt with without incurring serious loss.

Fortunately, however, another course may be successfully followed. This consists in establishing, under the gradually lightening canopy, a new crop of young trees which may make good its shelter-giving deficiencies. The "under-crop" must of course consist of "shade-bearing" species, such as beech, hornbeam, silver fir, or spruce, otherwise it could not establish itself under the canopy of the "over-crop"; but even then, if "underplanting" is to be undertaken early enough to do good, some thinning of the over-crop, by the removal of the worst of the trees, is usually needed to afford sufficient light for the development of the new under-crop.

Such underplanting, if done before the over-crop is too old, and before the impoverishment of the soil has gone too far, will enable crops of oak, larch, and other light-crowned species to maintain a satisfactory rate of growth up to a profitable age, and it may even suffice to restore vigour to a crop which has begun to decline from the causes under discussion, provided the evil has not gone too far.

The two crops grow on together; the trees of the over-crop are removed gradually as they attain the desired girth or interfere too much with the due development of the under-crop, and the latter may then be either cleared off or allowed to stand for a further period to increase its dimensions, as may at the time seem best.

From the above it will be seen that underplanting is done entirely in the interest of the over-crop. The under-crop is of quite secondary importance; and it would never, for its own sake, be planted or sown as such, for the simple reason that the over-crop standing among and over it is not only of no use to it, but after a comparatively short number of years becomes a distinct impediment to its development, by depriving it of light and of the benefit of light rainfall. The under-crop will, no doubt, have some value; but the object in view is not the realisation of this value, as the under-crop yields its profit indirectly, through the favourable influence which it exercises on the development of the more valuable over-crop.

A crop of dense-crowned species such as beech, spruce, or silver fir cannot, of course, be underplanted at all, and it is

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quite useless to underplant a crop of the light-crowned species unless the following conditions exist:—

1. The species of which the crop consists must yield timber of high commercial value, which increases with the girth of the trees.

2. The trees must be of good shape, so that they may, when felling time arrives, cut up well.

3. The trees must be sound, and they must be young enough to be capable of further vigorous development under the treatment applied.

To underplant a crop which does not fulfil these conditions is a mere waste of time and of money. It will not be benefited to a remunerative extent, while the development of the crop established beneath it will be impeded by it. Unpromising crops, even of valuable species, which have no future, should be removed as soon as other circumstances may permit, and the ground should then be restocked.

If a species be susceptible in youth to frost or drought, shelter for it can be provided in other and better ways than by planting it under the shade of a valuable over-crop, which must stand over it, to its detriment, much longer than is necessary for its protection. But a crop which does not fulfil the above conditions may be used as a *temporary* shelter-wood for tender species, the old trees being removed as soon as the new crop no longer needs their shelter.

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29. Experiments on the Relative Value of certain Timber Preservatives.[1]

Professor Henry has recently carried out a series of experiments on the relative value of certain antiseptics recommended by various authors as means of protecting timber from the attacks of fungi, or wood-destroying insects, and from the injurious effect of the soil, and we summarise below his chief results, as set forth in his pamphlet. The object of the experiments was purely practical, for they had as aim the investigation of the question as to the best preservatives to be used by private individuals, or others unable to set up costly plant. Professor Henry points out that a good preservative should fulfil the following conditions:—the substance should be unalterable, and should not only destroy pre-existing germs of destructive organisms, but should prevent—indefinitely if possible—the access of new germs from the exterior; it should not alter the force of resistance, the hardness, elasticity, and other qualities of the wood, but should either leave these in their original state or improve them; it should penetrate easily to all parts of the wood, and fix itself permanently within the elements; it should not be poisonous or dangerous; it should be of constant and definite composition; if possible, it should not have a strong or disagreeable odour, and it should not change the colour of the wood; finally, it should be of a sufficiently low price to make it worth while to use it in preference to replacing the damaged wood.

Eight preservatives were chosen as subjects for experiment, the selection being made from among those which previous experiments seemed to point to as having considerable value. These eight were as follows:—(1) Avenarius' patent carbolineum; (2) carbolineum, Lion brand; (3) gas-tar; (4) microsol; (5) antinonnine; (6) antigermine; (7) lysol; (8) hydrofluoric acid. Carbolineum is a commercial term for an extract of coal-tar containing creosote. The brand invented by Avenarius is distinguished by its high density and viscosity, while the Lion brand is less dense and less viscous. The tar employed was obtained from the gas-works of Nancy. Microsol is a pasty mass soluble in water, formed of copper sulphate united to some organic matter.

[1] *Preservation des Bois contre la Pourriture par le sol, les Champignons et les Insectes*, par E. Henry, Professeur à l'école nationale des eaux et forêts. Berger-Levrault et Cie, Nancy. To be obtained from the author. Price 4 francs. 1907.

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Antinonnine is a dinitro-cresylate of potassium, which has been highly praised by some experimenters. It colours the wood a strong yellow. Antigermine is a green mixture, which, like antinonnine and lysol, is a derivative of creosote. Lysol is a solution of cresylol in soap, and is completely soluble in water. The hydrofluoric acid used was the ordinary commercial product. The woods used for the purpose of experiment were silver fir (*Abies pectinata*), Aleppo pine (*Pinus halepensis*), oak (*Quercus robur*), beech (*Fagus sylvatica*), poplar (*Populus*). Three specimens were experimented with in each case. The specimens were cut green, were dried first in the air, then in a stove, and were then immersed in the solutions, the conditions being identical in all experiments. The immersion lasted for twenty-four hours, and the solutions were heated over a water-bath to 140° F. Although this uniformity of procedure was adopted to ensure a fair trial, yet in point of fact there are great differences in the rate of impregnation of different woods, and the time can in many cases be much shortened. The author gives full details of a series of subsidiary experiments having for their object the determination of the rate of impregnation of different woods, but for these reference must be made to the original pamphlet.

After treatment with the antiseptics, the samples of timber were placed under two sets of conditions. One set were exposed in the open air in a garden where they were almost buried in leaf-mould or manure, the free end being fully exposed to the influence of snow, rain, and sun. The other series were placed in the galleries of the iron-mines of Lorraine. These galleries run at about 33 feet below the surface, have a constant temperature of 50°-54° F., and are completely protected from rain and sun. Though adequately ventilated, the air in them is only slowly renewed, and all the conditions are thus favourable to the development of wood-destroying fungi, notably dry-rot, which is very prevalent. Some of the specimen cubes were in actual contact with infected planks. The experiments lasted three years, and seem to have been conducted with the greatest care.

The method of immersion practised allowed both the varieties of carbolineum to penetrate to the centre of the poplar, the beech, and the fir, while in the case of the oak and Aleppo pine the whole of the sap-wood was impregnated and parts of the hard-wood. This shows that with this preservative it is not necessary to have recourse to vapour or to impregnation under pressure. The degree of impregnation is indicated by the brown colour

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produced by the reagent. Microsol has equal penetrative power, but the degree can only be demonstrated by testing for copper. Taking first the specimens exposed in the open, the following results were obtained. Of the "control" specimens left in the open *without any preservative*, the fir was the best preserved, and after it the Aleppo pine. The specimens of oak, beech, and poplar not treated were at the end of three years so decomposed that their replacement would be necessary in actual use. But the specimens treated with lysol, antinonnine, and hydrofluoric acid were equally or more decomposed. On the other hand, the specimens of oak, Aleppo pine, beech, poplar, and fir treated with either of the brands of carbolineum, with coal-tar, or with microsol, remained unaltered, and were as serviceable as at the outset of the experiment.

The second series, the specimens placed in the mine galleries, showed the following results. First as to the controls; after the poplar the fir was the most altered, whereas in the open the fir is the most resistant; the beech was also much altered, while the heart of the oak remained sound. The specimens impregnated with the two brands of carbolineum, with gas-tar, and with microsol remained intact, and this is true of all the five species experimented with. Thus these four preservatives proved themselves equally valuable in the case of timber in the open and timber under shelter. The least certain of the four is, however, the tar, so that the contest for the first place is limited to the two carbolineums and the microsol. Antinonnine and hydrofluoric acid had a favourable effect on the specimens placed in the mine galleries, which is in marked contrast to their absence of preservative action on timber placed in the open. The specimen of fir treated with antinonnine and placed in the mine galleries was perfectly preserved, while, as already mentioned, the control specimen was much altered.

The hydrofluoric acid also had a preservative effect upon the sap-wood of oak. As to the lysol, it had no preservative effect, and is to be rejected alike for timber under shelter and in the open. The experiments with antigermine were less elaborate than with the others, but they showed that this substance does not prevent the development of fungus mycelia in the wood of beech, while it has a preservative effect on fir.

The result of the series of experiments then is to emphasise the value of carbolineum and of microsol. The question as to which should be employed can only be solved by a consideration

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of the special conditions in each case. The following considerations are important in forming a decision. Carbolineum imparts to the timber treated by it a persistent odour which many find disagreeable, and which might possibly taint food, etc., placed in closed cellars, sheds, etc., whose wood had been treated with it. Again, it soils to a considerable extent both the clothes and the hands of the workmen using it, and precautions have to be taken to protect the skin and eyes against its irritating effects, this being especially true when it is employed hot and within closed spaces. Further, timber treated with carbolineum cannot be painted, for, even after a long period of drying, the preservative diffuses through and alters the paint, producing long brown marks. In the case of skirting-boards and wainscoting, it is, however, sufficient if the side in contact with the wall is painted with carbolineum, and if this is not done until after the front face has been painted, and has thoroughly dried, the paint will not be affected. If, however, it is desired to leave the wood in its natural colour, microsol is indicated. This product has no smell, does not produce irritating vapours, does not prevent the wood being painted, and seems generally to be indicated for wood in the interior of buildings, while carbolineum should be reserved for that to be exposed in the open.

In a final section the author discusses the damage done to wood by various destructive insects, the means of recognising the more important of these, and methods of prevention or of cure. Thus he gives an illustrated account of *Hylotrupes bajalus*, which attacks all the useful conifers, and is extremely destructive. A characteristic which renders it especially destructive, is that it may go on breeding for many successive generations without the perfect insects ever appearing at the surface, and thus the beams, etc., attacked, may be completely destroyed internally before the presence of the beetle is suspected. A simple and efficient preventive measure is to paint the surface once or twice with hot carbolineum. The same antiseptic can be applied to wood already attacked, and will prevent further damage. Similar treatment will prevent the attacks of *Termes lucifugus*, which is becoming more and more common in south-west France.

The author also discusses at some length the ravages of the common wood-borers *Anobium*, *Ptilinus*, etc. Here again one of the antiseptics named above, especially carbolineum or microsol, is the remedy indicated. MARION I. NEWBIGIN.

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30. The Northern Branch of the Royal Scottish Arboricultural Society.

Visit to the Lovat Estates.

The Members of the Northern Branch of the Scottish Arboricultural Society held their first excursion, which was to the Lovat Estates, on Saturday, 13th July 1907. The party, numbering about forty, were met on arrival at Beauly by Mr J. T. Garrioch, on behalf of Lord Lovat, and Mr Gilbert Brown, forester on the Lovat Estates. Maps and notes concerning the origin and future management of the woods to be visited were handed to each of the party.

Balblair Wood was first visited. This wood, extending to about 130 acres, owes its existence entirely to natural regeneration. Within its area 104 acres have trees about 55 years of age, while 26 acres carry trees of about 35 years of age. It was agreed that Balblair Wood was one of the best examples of natural regeneration in this country. From Balblair the party drove to Beaufort Castle, where they were entertained to luncheon by Lord Lovat.

The party then inspected other woods. In Lonbuie Wood, the matured timber was cut in 1902, and the replanted area amounts to about 19 acres. As the condition of the soil differs in certain parts, four different species have been planted, namely, larch, spruce, Scots fir, and some Douglas firs. The nursery contains 4 acres, where the young plants are reared from seeds sown. Great interest was taken in the nursery, the fine condition of the beds and young plants being specially admired. Sawmill Wood extends to 1 acre, one-fourth of which was planted in 1898 with Japanese larch and spruce, alternately, 4 feet apart, the remaining three-fourths being planted in 1900 with Douglas fir. The strip (especially the Japanese larch) was greatly admired, these trees being in most cases about 25 feet high. Alder, extending to 20 acres, is being used for the experimental plots. A great many of these plots are made up of larch planted in different ways, some pure, others mixed with beech and sycamore, the idea being to note exactly if there is any difference in the incidence of disease on the larch planted under different systems. Dunballoch and Cononbank Woods extend to 120 and 130 acres respectively. The former was planted with Scots fir twenty

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years ago, and the latter with Scots fir twenty-five years ago. In connection with these woods, which are good specimens of closely planted woods, the opinion was generally expressed that it would be unnecessary to do any thinning out, with the exception of the removal of dead and suppressed trees, for a number of years yet.

Meeting of 28th September 1907.

A meeting of the Society was held in the Town Council Chamber, Inverness, on 28th September. Mr J. Grant Thomson, Grantown-on-Spey, President of the Branch, occupied the chair.

Mr J. Grant Thomson then addressed the meeting, his subject being "Forestry, Past and Present." Mr Thomson said: "Brodie of Brodie and Gentlemen, you have conferred an honour upon me that I never coveted, never expected, and I fear never merited; but since you have elected me as the first President of this Branch of the Royal Scottish Arboricultural Society, I will hope for your sympathy and kindly support. I can only assure you of my high appreciation of so signal a mark of your good opinion. No doubt there may be some difficulties to overcome, but with prudence, patience, and hearty co-operation, I trust this Branch may be a benefit, not only locally, but to the country at large, and especially to the Highlands. You are all aware of the object we have in view, namely, to assist and encourage afforestation. I need not dwell on that subject. Gentlemen, I can now look back over nearly sixty years of active work, and can remember many changes that have taken place. Few can say that their connection with forestry is so lengthened as mine has been, and I daresay fewer still can say that they have served for the length of time that I have done under the same family. And here I cannot but pay the grateful tribute of saying that there never were more considerate proprietors than the noble family of Seafield, or any that I know of so much interested in arboriculture and everything connected therewith. By their generous consideration and indulgence, I have been permitted to visit other estates, and you will pardon me for mentioning that there is scarcely a county in Scotland, from Berwick to Sutherland and from the island of Mull to Aberdeen, where I have not been employed; and while I hope I was of some benefit to those who asked my advice, I also was benefited myself, and saw some things that could not be seen in one locality. In these wanderings I have come across

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some plantations that have been exceedingly well managed, some that have been fairly well cared for, and others on which I would rather not make remark. Sometimes I have been asked as to the best method of managing woods, but more frequently my advice has been sought about how to get money out of woods, or how to use them for game cover. But, gentlemen, I am not going to give a history of myself or of what I have seen or done. I will confine the few remarks I am to make to the extent and cost of forest operations fifty years ago as compared with the present time, and to the prospects of forestry in the Highlands in present circumstances.

A Retrospect and Comparison.

"Notwithstanding all the Arboricultural Society has done to increase an interest in forestry since it was inaugurated in 1854 (and that is not little), my belief is that there is not nearly the same extent of ground being put under trees at the present day as was the case fifty years ago. It is impossible to find out the areas exactly; nurserymen naturally enough hesitate to state what number of forest trees are grown now as compared with the date I refer to, but nearly all of them say that there is now less ground under trees in nurseries than formerly, and, as a consequence, there must be fewer trees grown in plantations. This is no fault of the nurserymen: given a market for the plants, nurserymen will grow them to supply any demand. I would like to mention some reasons for this shortage of planting. Now, gentlemen, bear with me; I am not a politician, and I hope nothing of that nature will ever enter into this Society; but if there is a shortage in planting now, there must be a cause or causes for it, and to my mind some of the following are the reasons. Fifty or sixty years ago there was a heavy tax on all timber imported from foreign countries, and prices of home timber were high in proportion. Besides, proprietors now are handicapped very much by death-duties and other taxation that did not exist in my younger days. Many a proprietor, when he comes into possession, finds heavy burdens on his estate that must be wiped off, and by the time this is done little may be left to expend on planting. It must always be borne in mind that, unless under exceptional circumstances, very few who plant can get much return for their outlay in their own lifetime. Still another reason for less planting being done is the value of game,

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which brings in ready money, and many proprietors, however willing to make improvements, are glad of a quick return. The last reason which I will mention is the increased expense of planting. I have got information from a very reliable source of the cost of fencing, draining, and planting a plantation of very nearly 1000 acres, now nearly 50 years old. The plants used consisted of Scots fir, larch, and a few spruce, all three years old, in the proportion of two Scots firs to one larch. The total cost (including everything save superintendence) was as nearly as possible thirty shillings per acre. This sounds to me, and I am sure to you, a very low figure, but I am confident my information is quite correct. Another plantation I have heard of, now about 80 years old, was planted at ten shillings the acre. I am certain this could not be done now for anything like the same price. The price of labour has increased, the price of plants has also risen enormously. About the year 1860 one-year seedling Scots firs could be purchased at £4 per hundred thousand, two-year seedlings at £5, and one-year one-year transplants at £12 per hundred thousand. A catalogue of a most respectable firm of nurserymen for the year 1906-1907 is before me. The prices given in it are—one-year seedlings, 4s. per thousand; two-year seedlings, 10s. to 12s.; and one-year one-year transplants, 14s. to 16s. per thousand—at least five times the previous prices. This is an exceptional year, but I am quite convinced that it will be a long time before we see the above-quoted low figures again. Then as to the price of labour. I remember in the year 1843 that in the South of Scotland men's wages were 7s. a week in summer and 6s. in winter. We all know what has to be paid nowadays. On the other hand, almost the only circumstances I can mention as having tended to increase the value of woodlands are the improvements in the manufacture of timber from the old sawpits to machinery of the finest possible kind, and the improvements in inland transport, from horse-haulage and river-floating to traction-engines, steam lorries, and railways. But though this has certainly tended to make woods more valuable, and in remote districts more saleable, it can hardly lead to increased planting in the case of proprietors who are in lack of ready money, and anxious for a speedy interest on their outlays. I remember that at one of the early meetings of the Society in Edinburgh, a very worthy forester, one held in estimation all over the country, rose and said: 'I have a letter

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from a friend in America, assuring me that the forests there are being cleared with such rapidity that they will soon be all cut down, and home-grown timber will rise in price by leaps and bounds.' This was fifty years ago; and I must say I have not yet seen such a tendency to the extent that was foretold. But that a rise in price will come some day there can be no doubt. Foreign supplies are getting farther inland, and I hear of little being done to reproduce. In Ireland, whence great supplies have come in the past, especially to the West Coast, little or no planting is being made. And in this country, if more ground is being cleared than is being put under young crop, the end will come.

"Now, what is to be done? Is our country to become more and more denuded of trees? Can nothing be done to secure to the Highlands of Scotland some of that increased outlay of money that will be spent in purchasing timber in future years? That there is plenty of waste land in the Highlands capable of growing timber to profit, I think no one will call in question. It would be a source of revenue to the country if even a portion of the money paid for foreign supplies could be spent at home; and I see no reason why it should not, if proper measures be adopted for this end. I do not see how individual proprietors (unless in exceptional cases) can accomplish much, though I know there are some proprietors in the country who have forethought and capital enough to go on planting. In the case of most proprietors the loss of grazing and shooting rents would be a serious consideration to begin with, and the capital needed would be difficult to provide; but much could be done if Government gave assistance, either by advancing capital at a low rate of interest, or by getting possession of large tracts suitable for planting, paying full compensation to the present owners. As to the actual extent of suitable ground, I have no accurate conception. I have heard it estimated at ten million acres, even twenty million acres. I fear that many who pass through the Highlands by train or steamboat, looking at the hill-sides, frequently say, 'What suitable ground for planting that is,' yet if it were walked over, and closely examined, large tracts might be found unsuitable, where it would be a waste of money to plant a single tree. I am convinced, however, that there are large tracts in the Highlands well adapted for the remunerative growth of timber. Let me here say that the larger the area

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enclosed, the less the outlay per acre for fencing, and if huts or tents have to be built for workmen, it is better to do this for 10,000 or more acres than for smaller areas.

"But the first question to be considered is, what is the actual extent of ground available and suitable for the purpose aimed at? Perhaps the best way to obtain this information would be to get a Government Commission appointed, as was done in the case of deer forests, and let them ascertain and schedule the different areas in the various Highland counties. Then, as I said before, let full justice be given to the proprietors. Let them sustain no injury or loss. If Government were willing in this way to purchase and plant the suitable areas, it is possible, and I think highly probable, that terms might be arranged in such a fashion, that while proprietors would be benefited, there would be no loss but a gain to the country and the Government. Apart from the ultimate money value of the woods (and, I may add, their artistic value in imparting an attractive character to the landscape), the employment created by afforestation on an adequate scale would be enormous. Hundreds of thousands of pounds would be spent in planting, fencing, etc.; and one can hardly imagine the amount of money that would be circulated when the crop came to be manufactured. It takes on an average as much money to manufacture a lot of timber as it costs to purchase it. In conclusion, I would say that I hope someone here—yes, many a one—will live to see the day when vast tracts of our Highland hill-sides will be clothed with thriving timber. Then there would be employment for a large population resident in the country, whose incomes would be secure, and whose contentment, because of comfortable homes and steady wages, would keep them at home in the Northern Counties, and prevent emigration to overcrowded cities or to distant countries. I thank you for the honour you have done me, and for the patient hearing you have given to these remarks. I trust that this Inverness Branch of the Society will be prosperous and useful. I was born in Inverness-shire, and though my home for the past forty-nine years has been chiefly in a neighbouring county, a large part of my work has been in Inverness-shire. If my advice or assistance can benefit this Branch in any way whatever, it is freely at your service."

A discussion followed, in which Brodie of Brodie, Mr Scott, Darnaway, Mr Alexander Fraser, and others took part.

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Visit to Inverness Nurseries.

On the invitation of Bailie Gossip, the Members of the Club and their friends visited Messrs Howden & Co.'s nurseries, through which they were conducted by the Bailie. He showed them a large quantity of first-rate plants of various ages, some grown from seed here, others purchased. The home-grown plants had the best appearance of any. Interesting experiments of transplanting at unusual periods were also viewed. One lot shown was transplanted in July 1906, and it looked quite healthy. The deduction was that these young plants made no root-growth until they had ceased their branch- and bud-growth. The Members also visited one of the numerous annexes of the nurseries, and saw several acres of seedling coniferous plants, of which a large proportion looked remarkably well, considering the extremely backward season. Bailie Gossip gave some interesting figures as to the quantities of seeds used in the various beds, each of which should produce 105,000 plants. There was some talk as to the testing of the seeds for germination purposes, and the view was expressed by practical men that there was little to be gained from such tests. The true test was the weight of the seed per bushel. Scots fir averaged 34 lbs. per bushel. The best results were always got from heavy seeds. Large seeds produced large plants, and small seeds small plants. The visitors were hospitably entertained by Bailie and Mrs Gossip, who, on the motion of Brodie of Brodie, were warmly thanked for their kindness.

Visit to Novar Woods.

On Saturday, 19th October, the Members of the Branch paid a visit to the Novar Woodlands. There was a large party.

The whole forest area here is practically immune from rabbits, but the result of their former depredations was seen in the scraggy appearance of many otherwise well-developed trees. Black game is now the great scourge. The damage they do to young plantations is extensive. The scheme of management is high-forest, and a rotation of crop of from 80 or 100 years; but owing to storms, the indiscriminate cutting down of wood in former years, and other causes, it will not come into full operation for many years to come. As soon as the last of the older woods have been felled, there will be a cessation of

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felling till the oldest of the younger woods reach maturity, which will be in a period of from 36 to 40 years after the final fellings. During the interval there will be plenty of work in the thinning and in the tending of the younger plantations.

Arriving at Novar railway station, the visitors proceeded to Evanton Wood, and made a rapid survey of the mixed crop of Scots fir, larch, spruce, Douglas fir, and beech of various ages. The larch and Scots fir were largely of spontaneous growth, the other varieties having been planted to fill up blanks, and to suit different conditions of soil and exposure. Douglas fir is largely used to fill up blanks, as it makes rapid headway in the shade. Both the natural and the planted crops gave indications of healthy and vigorous growth. On the hill, which extends from the village for about two miles, is planted a mixed crop of larch, Scots fir, Douglas fir, with mountain pine at the summit, all of which are making excellent growth A crop of Douglas fir on the edge of the Black Rock was greatly admired. The outstanding features of the plants were their healthy appearance and their remarkable development. Natural regeneration is encouraged, because, barring accidents, a carefully trained natural crop usually gives excellent results. To produce a natural crop, the method employed all over the estate is that, when an old wood is being felled, "standards"—that is, solitary trees which are scattered over the whole area of the wood—are left standing to restock the ground by natural means. When the young plantations reach a certain height, the "standards" are cut down. The blanks are then filled up with shade-bearing plants, chiefly Douglas fir. No material damage is done to the surrounding plantation by the felling.

Crossing the Black Rock, the lower belt at Assynt was next visited. The age of this plantation is about 19 or 20 years, and it is composed of Scots fir, larch, and spruce, with a few hardwoods. Chief interest centred in the Scots fir, which appeared to want thinning. Here the scheme seemed to be the survival of the fittest, and, in comparison with the whole, the badly-developed and dead trees were in a very small minority. A brief inspection was made of the Assynt west belt, which was composed of larch, Scots fir, and spruce planted pure, the age of which was 19 years. The spruce plot was greatly admired, and, it was thought, would give better results than the preceding one. The Black Rock Wood, with its stock of Scots

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fir and larch, aged 100 years, was visited next. Not only here, but throughout the whole route, magnificent specimens of old timber were inspected. Assynt Hill was rapidly gone over. The crop here was larch, Scots fir, and Douglas fir, from 20 to 23 years old. Some few years ago larch disease was rampant in the larch plantations, but the cutting out of diseased stems, and underplanting with such valuable conifers as Douglas fir, Sitka spruce, Lawson's cypress, Hemlock spruce, *Thuja gigantea*, *Abies grandis* and silver fir, seem to be putting a stop to the ravages of the disease. When the crop had been thinned and underplanted, it presented a magnificent appearance. The *Grandis* seemed to be in a more flourishing condition than the Sitka, but the Hemlocks were the best of the lot. The Sitka, however, were planted later than the others, and they do not get on well in a damp soil. A break of silver fir which was planted in among the larch seemed to be doing well, but in the open silver fir makes no great headway. The ages of the young underplanted plots ranged from 1 to 4 years.

Several patches of the larch plantation were left unthinned—they will be thinned in time—and they presented a very scraggy appearance. The diseased stems were seen at a glance, and the ground was rank with coarse grass, whins and brackens. Plots of spruce were forging ahead, and were much better in every way than the larch. A plot of *Thuja gigantea*, which was planted last spring, appeared to be doing very well in the shade. The larch in the centre of the plantation was not nearly so good as that on the outskirts. This was perhaps due to the quality of the seeds. The following will give an indication of the revenue derived from the thinnings. The smaller posts or stakes are sold at 2s. a dozen, the middle-sized ones at 3s. 6d. a dozen, and the large ones at 4s. a dozen, or 4d. each. The cost of dressing them is 2d., 3d., and 1s. per dozen respectively. Much damage is being done to the young larch and Scots fir plantations on the Meannchnoc by black game. About two years ago a plot was planted with strong, healthy firs, and another with smaller ones. The first got away beyond the reach of the black game all right, but the latter plot was attacked, and the plants are stunted and bushy. This was merely tried as an experiment, but the expense was rather heavy. On the Broomhill and the Old Nursery the Douglas firs were making great headway; so, too, were the other conifers.

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The Novar Nurseries.

The party then visited the nurseries, which are from 8 to 9 acres in extent. Here they saw a vast array of all kinds of plants in various stages of development. The nurseries were in excellent condition, and were kept remarkably clean. Plants of all descriptions and of all ages were in the healthiest condition. Seed-beds planted in the shade of the apple-trees in the garden were also visited, but there seemed to be no difference in their growth from the beds in the nurseries. The curiosities in the museum having been inspected, the visitors had a walk through the experimental plots in the Dalzheal. Here have been carried on experiments in planting certain crops, some pure and others mixed, by notching and by pitting. There seemed to be not much difference between the results of the notching and the pitting, as all the plots appeared to be in a flourishing condition. The notching, however, is done at half the cost of pitting, while dibbling, again, is done at half the cost of notching. The Cross-hills was the last of the plantations visited. The crop was composed of larch and spruce, the age of the larch being 21 years and the older spruce 16 years. Part of the larch crop was thinned and underplanted in 1899 with spruce, silver fir, and Sitka spruce. The remainder was thinned in 1903, and underplanted with Hemlock spruce, *Thuja gigantea* and Douglas fir. Here, as in Assynt Hill, larch disease was at one time very prevalent. The plantation is now an excellent one all round, and, as regards underplanting and the combating of the larch disease, the best results have been obtained in this section. The Sitkas, which were planted some nine years ago, ranged from 10 to 16 feet in height, but the Hemlocks made the best show. They were planted five years ago, made rapid headway, till now their height is from 6 to 8 feet. The objection to this underplanting that many put forth—and it was the only one—was the difficulty that would be experienced in thinning and hauling out the trees without doing extensive damage. The chief difficulty, it was contended, would be in hauling the trees out from the centre of the plantation. There is not much in this objection. The plantations are intersected by "rides," and the distance from the centre of a plot to a "ride" is not great.

An instructive and enjoyable day terminated with a visit to the creosoting plant. The visitors were entertained to luncheon by Mr, Mrs and Miss Meiklejohn at the Dalzheal.

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31. The Aberdeen Branch.

Excursion to Durris.

The third excursion of the Aberdeen Branch of the Society took place on Saturday, 29th June 1907, when, by the kind permission of H. R. Baird, Esq., a visit was paid to his beautiful estate of Durris.

The party were received on arrival by Mr Braid, the factor on the estate, and Mr Crozier, head forester. They first passed along the main road to inspect a number of young Douglas firs planted in the form of a road-side belt among a sprinkling of old trees, larches, Scots firs, etc.; these demonstrated how well the Douglas fir thrives under partial shade.

Passing the old historic mansion, the company found its way to the estate nursery, which, without question, is among the best laid out and cultivated place of the kind to be met with on any private estate. Here were to be seen large brakes of plants comprising samples of all the imported trees which abound on the estate, particularly Douglas fir, Menzies (Sitka) spruce, varieties of the silver fir, Albert (Hemlock) spruce, etc. All these are from the north-western parts of America, and have proved themselves to be the trees best adapted to succeed in this country. These imported species have now been so long on Durris, that nearly all the seed used can be gathered off carefully selected trees on the estate.

The party's next move was to visit the experiment with Menzies spruce at Strathgyle. Strathgyle is a plantation of some 80 to 90 acres, planted twenty-nine years ago. The altitude is 900 feet, and the exposure north-easterly. Here, on a peaty soil resting on boulder clay, are to be seen Menzies (Sitka) spruces grouped alternately with other spruces, Scots fir and larch. The Menzies spruce is, however, at least three times bigger than its ally the Norway spruce of the same age, while the Scots fir and larch are comparative failures; even a sprinkling of Douglas fir, planted by way of experiment, seems to hold its own better than the two last named, notwithstanding the altitude and exposure.

Afterwards a business meeting of the Society was held, when, on the motion of Mr Hart, Cowie Mains, Mr Braid was called to the chair.

After the meeting the company broke up into groups and visited many parts of the extensive policies, especially the den where are to be found many of the fine old oaks and larches said to have been planted during the Duke of Gordon's proprietorship. Some of the larches measure over 100 feet high and from 8 to 10½ feet

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in circumference at 5 feet up. Here also, as in other parts of the grounds, were to be seen growing in forest form many imported trees, such as Douglas firs, silvers, Menzies spruce, and even Albert spruces, Cypresses, Wellingtonias, all making fine clean shapely stems like any ordinary forest-tree.

The west avenue, the *Nobilis* avenue, and many other noteworthy objects in this home of rare trees, were also inspected. Among the trees specially noted were the following—a fine old "Douglas" now about 70 years of age, 112 feet high, 12 ft. 6 ins. circumference at 5 feet up; the pendulous branchletted spruce, a rare and beautiful variety of the Norway spruce; an *Abies magnifica* 85 feet high, and 7 feet in circumference at 5 feet up, said to be the largest of its kind in the United Kingdom.

At the saw-mill several large planks of Douglas fir and Menzies spruce were shown partly planed. The Douglas had a fine reddish appearance, and ex-Provost Fleming, whose opinion, from his extensive connection with the timber-trade, must be respected, expressed himself to the effect that the Douglas fir lent itself to a high polish and finish, and was therefore well adapted for house construction, etc. The Menzies spruce was whiter, and otherwise not so suitable for highly finished work.

When all this had been seen, a re-union was again effected at Durris Cottage, the beautiful home of Mr and Mrs Braid, where a sumptuous tea and other refreshments were set out on the lawn by Mrs Braid. Before mounting the conveyances, Mr Gammell of Drumtochty proposed thanks to Mr and Mrs Braid for their substantial remembrance of the Society's human needs. If anything could attain to pleasure and profit alike, it was this visit of the Arboricultural Society to Durris. The former is unquestioned, while, at the same time, many practical lessons were to be learned by the student of forestry.

I am sure that those of us who have some practical knowledge of forestry can, from our observations at Durris, added to former experience, unhesitatingly assure even the most cautious of our landed proprietors and others interested, that a profitable investment can be obtained by planting as forest-trees some of the newer conifers, such as Douglas fir, Menzies spruce, etc.

Durris, by its nearness to the city and the many object-lessons it affords, will no doubt be highly appreciated by Mr Dawson, the recently appointed lecturer at Aberdeen University, and his students.

JOHN RULE, Forester, Huntly.

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32. Forestry Section in the Scottish National Exhibition, Edinburgh, 1908, organised by the Royal Scottish Arboricultural Society, 1st May to 31st October.

As soon as it was definitely known that a Scottish National Exhibition was to be held in Saughton Park, Edinburgh, the Council of the Society arranged that an Exhibit of Forestry should be included in it. A suitable space in the North Garden, facing the main avenue, was allotted free of charge to the Society, on part of which a Pavilion, hired for the occasion from Mr John M'Manus, London, was erected to receive such of the Exhibits as required to be kept under lock and key; on another part a shed has been put up to protect the timber boards from the weather, and the remainder of the space is occupied by Exhibits which do not require special protection.

It is intended that a detailed report of the Society's Exhibit be published in a future issue. Meanwhile we give a list of the names of those who have been good enough to respond to the Society's invitation to enter Exhibits under the headings given below, viz.:—

Specimens illustrating the Rate of Growth of Trees.

W. Steuart Fothringham, Esq. of Murthly.
The Right Hon. The Earl of Mansfield.
The Right Hon. The Earl of Strathmore.
R. C. Munro Ferguson, Esq. of Raith and Novar, M.P.
His Grace The Duke of Atholl, K.T.
Cameron of Lochiel.

Specimens of different Kinds of Timber.

W. Steuart Fothringham, Esq. of Murthly.
The Most Hon. The Marquis of Zetland, K.T.
The Right Hon. The Earl of Mansfield.
A. W. Inglis, Esq. of Glencorse, Midlothian.
The Right Hon. The Earl of Strathmore.
R. C. Munro Ferguson, Esq., M.P.
His Grace The Duke of Atholl, K.T.

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The Most Hon. The Marquis of Breadalbane.
Henry R. Baird, Esq. of Durris, Drumoak, Aberdeenshire.
His Grace The Duke of Wellington, Heckfield, Winchfield, Hants, per Mr W. R. Brown, Forester.
The Right Hon. The Earl of Carnarvon, Highclere Castle, Newbury, Berks, per Mr W. Storie, Forester.
The Right Hon. Viscount Powerscourt, Ireland.
David W. Thomson, Esq., Nurseryman, Edinburgh.
Messrs A. & R. Brownlie, Timber Merchants, Earlston.
Mr Alex. Pollock, Royal Rustic Builder, Tarbolton.
Adam Spiers, Esq., Timber Merchant, Edinburgh.
James Whitton, Esq., City Chambers, Glasgow.
George Cadell, Esq. (late Indian Forest Department), 20 Murrayfield Avenue, Edinburgh.
Messrs James Jones & Sons, Ltd., Larbert Saw-Mills.
H. J. Younger, Esq. of Benmore, Argyllshire.
The Right Hon. The Earl of Rosse, Birr Castle, King's County.
Sir Duncan E. Hay, Bart. of Smithfield and Haystoun, Peebles.
Messrs Alex. Jack & Co., Ltd., Maybole.
F. R. S. Balfour, Esq., Dawyck, Peebles.
Messrs J. & M. Smith, Peebles.

Specimens showing the Comparative Quality of Timber grown on different Soils and Situations, and the respective Ages at which each reaches Marketable Size and Maturity.

His Grace The Duke of Roxburghe, K.T.
His Grace The Duke of Northumberland, K.G., Alnwick Castle.

Gates, Fencing Material, Railway Timber.

W. Steuart Fothringham, Esq. of Murthly.
The Right Hon. The Earl of Mansfield.
His Grace The Duke of Roxburghe, K.T.
R. C. Munro Ferguson, Esq., M.P.
The Economic Fencing Co., Ltd., Billiter House, London, E.C.
Mr James Kay, Barone, Rothesay.
Colonel F. Bailey, Lecturer on Forestry, Edinburgh University.
H. J. Younger, Esq. of Benmore, Argyllshire.

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Specimens of Stems illustrating the effects of Dense and Thin Crops in Branch Suppression and Quality of Timber.

His Grace The Duke of Northumberland, K.G.

Specimens of Timber Preserved by various Methods.

The Right Hon. The Earl of Mansfield.
His Grace The Duke of Roxburghe, K.T.
R. C. Munro Ferguson, Esq., M.P.
Messrs Major & Co., Ltd., Hull.
The Economic Fencing Co., Ltd.
Mr George Leven, The Cottage, St Quivox, Ayr.

Specimens showing the Beneficial Effects of Pruning when well done, and Injurious Effects when badly done.

His Grace The Duke of Northumberland, K.G.

Specimens of Abnormal Growth.

The Right Hon. The Earl of Mansfield.
The Right Hon. The Earl of Strathmore.
R. C. Munro Ferguson, Esq., M.P.
The Right Hon. Lord Leith of Fyvie.
Mr James Kay, Barone, Rothesay.

Plants, Trees, and Timber damaged by Storms, Frosts, Insects, Animals, Birds, or other Causes, and Specimens of the Insects, Animals, Birds, or Fungi which caused the damage.

Dr Stewart MacDougall, Hon. Entomologist to the Society.
Dr A. W. Borthwick, Hon. Cryptogamist to the Society.
W. Steuart Fothringham, Esq. of Murthly.
Mr George Anderson, Braehead, Cumbernauld.
The Right Hon. The Earl of Mansfield.
Captain W. B. Rankin of Cleddans, etc.
R. C. Munro Ferguson, Esq., M.P.

Young Trees showing various Methods of Transplanting.

R. C. Munro Ferguson, Esq., M.P.

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Specimens illustrating Forest Botany.

Dr A. W. Borthwick, Hon. Cryptogamist to the Society.
W. Steuart Fothringham, Esq. of Murthly.
The Right Hon. The Earl of Mansfield.
F. R. S. Balfour, Esq., Dawyck.

Tools, Instruments, and Implements—Home and Foreign—used in various Operations connected with Forestry.

Messrs Robert Sorby & Sons, Ltd., Sheffield.
R. C. Munro Ferguson, Esq., M.P.
Mr James Kay, Barone, Rothesay.
Colonel F. Bailey.
The Right Hon. The Earl of Mansfield.

Working-Plans, Maps, etc.

R. Campbell, Esq., B.Sc., Hon. Geologist to the Society.
Dr Schlich, C.I.E., F.R.S., Professor of Forestry, Oxford University.
Colonel F. Bailey.
Sydney J. Gammell, Esq. of Drumtochty.
J. G. Bartholomew, Esq., The Geographical Institute, Edinburgh.

Specimens of Rustic Work.

Mr Alex. Pollock, Royal Rustic Builder, Tarbolton.

Pictures and Photographs in connection with Forestry.

Royal Scottish Arboricultural Society.
The Right Hon. The Earl of Mansfield.
His Grace The Duke of Roxburghe, K.T.
R. C. Munro Ferguson, Esq., M.P.

Instruments for Measuring Height and Diameter of Trees, etc.

Messrs J. & M. Smith, Peebles.
Colonel F. Bailey.
Mr James Kay, Barone, Rothesay.

Tanning and Dyeing Substances derived from Forest Produce.

The British Dyewood & Chemical Co., Ltd., 53 Bothwell Street, Glasgow.

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Wood Pulp and other Materials for Paper Manufacture.

Messrs Thomas Tait & Sons, Ltd., Inverurie Mills, Inverurie.

Other Objects of Interest relating to Forestry.

W. Steuart Fothringham, Esq. of Murthly.
A. W. Inglis, Esq. of Glencorse.
The Right Hon. The Earl of Mansfield.
His Grace The Duke of Atholl, K.T.
Mr James Rodger, Estate Office, Leinster Street, Athy, Co. Kildare.
Mr John Thomson, Gormaddie, Balmoral, Ballater.
Messrs J. & M. Smith, Cabinetmakers, Peebles.
Royal Scottish Arboricultural Society.
H. J. Younger, Esq. of Benmore.
F. R. S. Balfour, Esq., Dawyck.

Mr Adam Spiers, Timber Merchant, Edinburgh, has supplied the flagstaff, and Messrs Dicksons & Co. and Mr David W. Thomson, Nurserymen, Edinburgh, have sent the decorative plants and shrubs.

The Society's attendant is Mr Alexander M'Rae, lately Forester at Castlecomer, Co. Kilkenny, who has made and fitted up the benches in the Pavilion, erected the shed for the timber, laid out the ground, and staged the Exhibits.

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NOTES AND QUERIES.

Arboriculture and Arable Land.

If it be true that nothing is more beautiful than the hedgerow timber and the scattered oaks and elms of the English Midlands, it is equally true that nothing is more destructive to agriculture than much of our "ornamental" timber in Scotland. A great deal could be done both to increase the value of arable land and to beautify the landscape, through a gradual process of change in the allocation of trees and in the varieties used. A really good tree, wherever situated, is worth some sacrifice to keep, and the general effect of the whole landscape should always be held in view. Subject to these considerations, much might be done in Scotland both for the adornment of the countryside and to increase the value and utility of our timber.

Trees planted round farm and other houses for shelter frequently exclude light, and spoil the gardens or roofs—whereas vacant spaces could be utilised, and real shelter provided in lieu of the original plantations, which, in many cases, serve only to create a draught instead of a "bield."

The "scrunty" elm, often an eyesore, at the roadside should disappear, along with the obnoxious weeds which flourish beneath its fostering shade; so also with the battered beech which lingers on to spoil the hedge or ruin the neighbouring crop. No tree should be left in an arable field that is not a fine tree and a feature of the landscape. Such trees are rarely necessary, as in the south of England, to shelter stock on the pasture lands.

Shelter-strips should always run north and south to protect the crops from prevailing winds, and to give every field its fair share of the sunshine. Hedgerow timber should consist mainly of oak, Lombardy poplar, birch, Scots fir, etc., and other varieties which throw least shade and therefore do the minimum of harm to hedge and crop. Probably the ideal border for a road is a beech hedge with oak standards, but a thorn hedge with Lombardy poplar and similar combinations is not to be

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despised. For house and garden shelter, the gean, mountain ash, laburnum, and oval-leaved privet are among the species insufficiently employed. Chestnuts, black Italian poplars and Acers will soon make a show on unutilised spots of bare land—and much of arable Scotland remains very bare—and will serve for shelter or for ornament. Beech, elm and ash should be clumped or grown in two or three close lines for avenues, else they will rarely become ornamental timber.

Corners where fields meet can often be planted with a clump of trees to the great advantage of the landscape. The willow, and especially its scarlet variety, too rarely gives colour to the margin of our streams and pools. Nor is the toom or ashpit often enough secluded by a diadem of *Retinospora* or other ornamental species. Apart altogether from large plantations, were landowners to take a more active interest in the disposition of ornamental timber, outside their policies, this would have a considerable effect upon the comfort and welfare of their tenants and their employees—whilst by removing the eyesores of stunted, hidebound, ill-grown standards, and by covering bare and ugly pieces of ground with shelter clumps for man and beast, the splendid natural scenery of Scotland would be further enhanced.

R. M. Ferguson.

The Ardgoil Estate.

The development and utilisation of the above estate, lately presented to the city of Glasgow by Mr Cameron Corbett, M.P., is of considerable interest from a forestry point of view.

The estate is situated in the parishes of Lochgoilhead and Kilmorich, and consists of 14,650 acres, the majority of the area being rough hill pasture land. The greatest elevation is found on the summit of Ben Ime, which attains a height of 3318 feet, while five other hills of over 2000 feet in height occur on the estate. Very few estates present such a minimum proportion of level arable ground.

The purpose for which the gift was made was to provide a place of resort for the citizens of Glasgow; and all revenues from the estate are to be devoted to the upkeep of the estate, and to rendering it more accessible to the inhabitants of

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the city. A large proportion of the area is probably suitable for growing coniferous timber, and that this would be a profitable course to adopt seems to be indicated by the fact that at present probably only twenty families gain a livelihood from the land. It is the firm conviction of Mr James Whitton, Superintendent of Parks, Glasgow (on whose report this article is largely based), that crofting, except to a very limited extent, would be a failure. The problem is therefore the same as that which exists over a large proportion of Scotland, that is, by what method can land of this description be utilised so that an increased number of persons may obtain a reasonable living wage from the soil?

The land in the Eberswalde district of Germany may be compared, in some respects, to the Ardgoil Estate, inasmuch as only small areas here and there are of agricultural value. The main distinction between the two is that the rainfall on the Ardgoil Estate is sufficient to produce a soil-covering of rough hill pasture even on the more barren portions, whereas at Eberswalde the soil is porous and the rainfall small. The woods on the Eberswalde district may be described as analogous to the rough hill pasture in Scotland.

It is a significant fact that while in Scotland the annual rental of land capable of growing grass is, in the case of hill pasture, often not more than a few pence per acre, in Germany an annual sum of about ten shillings per acre is realised for a planted area, most of which could not produce pasture. There is some doubt as to the effect of a possible influx of visitors on the farms of the Ardgoil Estate, with the consequent disturbance of stock. The official report draws attention to the fact that "the afforestation . . . of a considerable area of the estate, merely to afford shelter, would enhance the value of the farms as grazing subjects, and would be an advantage. There is, however, the larger question of *creating a source of revenue for the future . . . by the planting of trees.*"

That the estate is capable of growing most of the common timber-trees, both hardwoods and conifers, is without question, and there is reason to believe that in former times woods covered a large portion of this estate. It is encouraging to find that a considerable amount of planting is likely to be undertaken, and that it will be done in a systematic manner.

W. F. A. H.

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Afforestation of Surplus Lands.

The following letter from Dr Schlich appeared in the *Times* of 10th April 1908:—

Twenty-two years ago I urged extended afforestation of surplus or waste lands in these islands. These suggestions I have repeated on many occasions since, and I particularly pointed out that such afforestation might be found an auxiliary in solving the Irish land question and the great problem of the unemployed. The reasons for my action were, in the first place, the desirability of increased afforestation, so as to increase home production; and secondly, my conviction that the operations would ultimately pay a fair interest on the outlay, provided they were conducted in an economic and business-like manner. The study of the forest conditions in various parts of the earth had shown me that a scarcity, or at any rate a considerable rise in the price, of timber must come within a limited period of time, so that woods planted in this country would benefit by that increase. My proposals remained unheeded for a considerable period of time; indeed, they were even characterised as "wild gambling in futures." Of late, however, the matter has been more seriously considered, and I have read with great interest the four articles on "British Forestry" published by you during the last two months. A Committee on Irish Afforestation is just completing its labours, and I have reason to believe that proposals made by me in January 1886 have been seriously considered. I also see that the Royal Commission on Coast Erosion has been enlarged, and is now considering "whether it is desirable to make an experiment in afforestation as a means of increasing employment during periods of depression in the labour market."

These are all hopeful signs towards the inauguration of extended action, especially as recent experience has shown the correctness of my forecast as regards the financial aspect of the undertaking. Our supplies of timber come chiefly from the countries around the Baltic and from North America, in the proportion of about five and a half to three million tons. It stands to reason, therefore, that any rise in price in North America must affect prices in these islands. This morning I received a statement issued by the United States Department of Agriculture, Forest Service, entitled "Wholesale Lumber Prices, 1886-1908," on the markets of New

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York, Baltimore, Buffalo and San Francisco, from which I trust you will permit my giving the following extract:—

The increase in prices during the last ten years has been as follows, in dollars per 1000 feet board measure:

Species.	1899.	1908.	Per cent. of Increase in 10 Years.
New York—White Ash, . . .	34	60	77
,, Birch, ...	35	54	54
,, White Oak, . . .	55	82	49
,, Yellow Poplar, . . .	25	46	84
,, Hemlock, ...	11·50	22	91
,, Spruce, ...	21	39·50	88
Buffalo—Hickory, ...	48	59·50	24
,, White Pine, ...	44	79	80
San Francisco—Redwood, . . .	17	35	106
Yellow Pine generally, ...	16	24	50

These increases must have produced a rise in prices in the United Kingdom. As a matter of fact, as I showed at a conference held last year at the invitation of Lord Carrington, the average increase all round since 1895 amounts to about 20 per cent., the increase not coming suddenly, but quite steadily year by year. As the United States must call more and more upon the timber resources of Canada, and as the population of the latter country is rapidly increasing, there cannot be a shadow of a doubt that the export of timber from North America to these islands must decrease, leading to a further increase in prices. In how far the countries round the Baltic can counteract that effect may be considered as problematic; at any rate, until now they have not been able to do so. These countries have also to meet the ever-increasing requirements of many other countries, such as Germany, Belgium, France, Holland, and many others.

These things prove that we have a fair field before us for increased afforestation of surplus lands, even if looked at from a financial point of view. I hope that the Commission on Land Erosion and the Committee on Irish Forestry will see their way to formulate practical proposals dealing with the subject on broad lines.

I am, Sir, your obedient Servant,

W. SCHLICH.

OXFORD, *6th April.*

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Forest Preservation in the United States.

A despatch in the *Times* of 12th May gives some account of the work which has been done by Mr Roosevelt's Administration in connection with the preservation of the timber resources of the United States. In the first place, experts have been for some time drawing attention to the effects produced by the reckless destruction of the forests. Thousands of acres of arable land, stretching from hill-sides and river banks, have been deprived of the protecting trees which regulate the periodic floods of the rivers. In consequence, the lands are being swamped by the overflowing streams, the courses of the rivers being in turn clogged with the rich soil stripped and washed from the land. This effect of deforestation demands costly dredging of the streams, and endangers the efficiency of works designed to facilitate navigation. The storage of flood waters also becomes a necessity, and reclamation schemes, in addition to being directed to arid lands, have also to be applied to once useful fertile areas over which the flood waters have ruinously spread through ruthless tree felling. One instance among several is the reduction of the amount of forest cover on the White Mountain watershed. Thereby the water-power in the New England streams has become insufficient to run the mills, and 95 per cent. of the water-power factories have had to use steam at certain periods of the year or else stop running.

Mr Roosevelt's crusade for the preservation of the remaining portions of the public domain not at the mercy of the squandering methods of private owners, has taken a form that will be enduring as far as it goes with the means at hand. In the West an over-abundance of land and a meagre population once encouraged a lavish distribution of the public domain for agriculture, timber, water, fuel, and minerals. Now it is recognised that these resources are not inexhaustible, and that their abuse must be stopped. A brilliant lieutenant of the President's, Mr Gilbert Pinchot, chief of the forestry service, has for some time been conducting a vigorous campaign against the further monopoly of the public lands, the benefit of which has accrued to a few individuals, who have ousted the *bona fide* home-steader. Considerable forest reserves have now been established in the West, and portions of the coal supplies and mineral fields have been conserved.

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The conservation of water-power, upon which in turn depend the forests, is quite as grave a question as that of the coal, to which considerable attention is now being devoted. It is said that water-power is becoming exhausted at the rate of millions of tons annually through the absence of forest control by the State. The snows and water in the great mountain ranges of the West, Mr Garfield says, contain enough power to turn millions of wheels, to irrigate millions of acres, and to furnish water supply to hundreds of cities. To this unused power commercial interests are naturally turning. But mindful of the spendthrift and monopolistic policy which has marked the control of the forest and mineral areas by the "interests," the Administration has sternly set its face against the granting of further franchises for the use of a natural agent that it conceives to be a public utility, not a private privilege.

The President has warned Congress that he will veto Bills which grant such privileges to private monopolies. As a part of the Administration's policies, this determination to thwart the creation of vested interests in water-power, to check further forest exploitation, and weaken the grip of illegitimate ownership of the forest and mineral areas, is certain to meet with bitter opposition in Congress, when in due time it takes the form of proposed legislation. But the whole situation calls for laws prescribing some intelligent system of national conservation, similar to that followed in European countries, aided by uniform laws in all the States.

Linked with Mr Roosevelt's plans for this conservation is his scheme for the improvement of inland waterways — a vital question daily becoming of more urgency. Far-reaching measures have been proposed by the Commission he appointed. In a weighty report submitted to Congress, the Commission recommended that hereafter plans for the commercial development of inland waterways should "take account of the purification of the waters, the development of power, the control of floods, the reclamation of lands by irrigation and drainage, and all other use of the waters or benefits to be derived from their control." Here is indicated the wonderful network of public interests bound up with the Administration's concern for the conservation and control of the national estate of the Republic.

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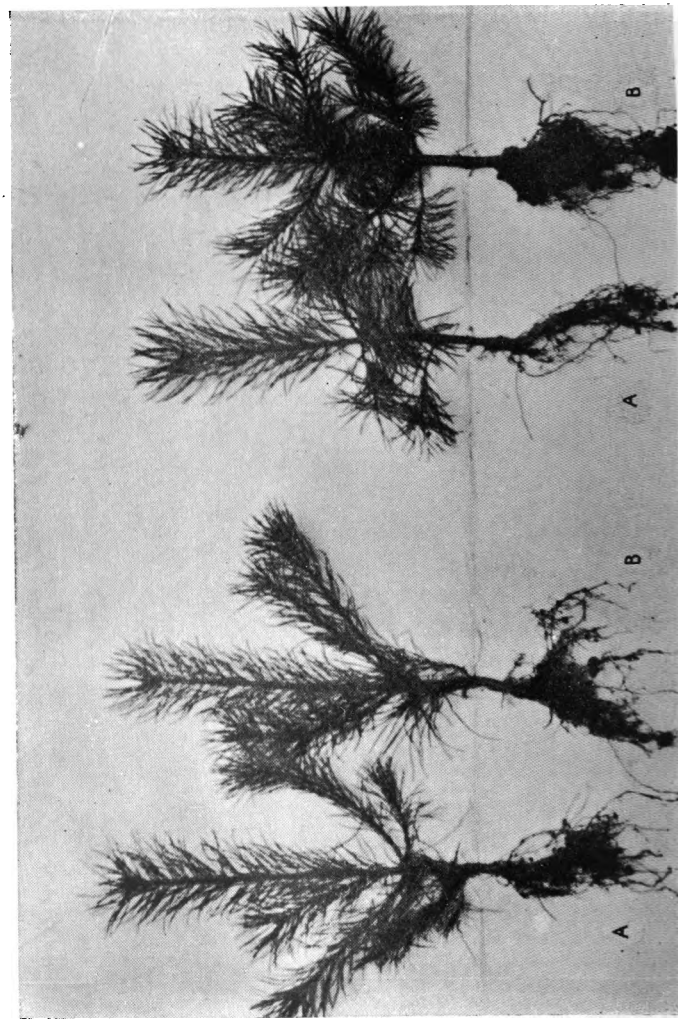
Plate XVI.



No. I.

No. II.

To face page 229.]

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Afforestation of Reclaimed Lands.

In connection with the subject of afforestation, the following official notice is of interest:—

"The King has been pleased to enlarge the terms of reference to the Royal Commission on Coast Erosion, and to direct them to inquire whether, in connection with reclaimed lands or otherwise, it is desirable to make an experiment in afforestation as a means of increasing employment during periods of depression in the labour market, and if so, by what authority, and under what conditions, such experiment should be conducted; and to add to the Commission the following new members:—Mr John Galvin, Mr E. Stafford Howard, C.B., Mr H. C. Monro, C.B., Dr W. Somerville, F.L.S., F.R.S.E., Mr Fraser Story, and Mr John Ward, M.P."

Basic Slag on Seed-Beds.

(With Plate.)

The value of basic slag as a fertiliser has been demonstrated and proved in many ways; but as I am not aware of its having been tested on seed-beds—in this country at least—I am sending the accompanying photograph, along with table of measurements and explanation.

Reference to Plate.	Age in Years.	Circumference at Ground.	Total Height.	Length of last Year's Growth.
		Inches.	Inches.	Inches.
No. 1—A, . .	3	$1\frac{3}{16}$	$13\frac{1}{2}$	10
,, B, . .	3	1	$12\frac{3}{4}$	9
No. 2—A, . .	4	$\frac{7}{8}$	$11\frac{1}{2}$	$6\frac{3}{4}$
,, B, . .	4	$1\frac{1}{8}$	$12\frac{1}{2}$	6

These measurements illustrate the rate of growth of two lots of Scots pine, the specimens measured and photographed being average sized plants of their respective lots.

Those illustrated by No. 1 were raised at Pollok, the seed having been sown in beds prepared in the usual way, and a light dressing of well-matured farmyard manure dug in; but, before covering the seed, basic slag was sown on the beds at the rate of about 12 cwts. per acre. This was the only special attention they received, except that during a spell of

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very dry weather they were watered several times. The following spring a number of the seedlings were lined out on the Corrour estate nursery at Fersit, and, at the same time, those illustrated by No. 2 were bought as two-years' seedlings, and lined out alongside of them, both lots receiving identical treatment then and since. The specimens in both cases were taken from a plot of selected seedlings.

Both lots of plants are very regular in size all over, but, if anything, there is less variation in the three-year-old plants than in the others. The No. 1 seedlings, however, have all along had a much better colour—quite noticeable even at a considerable distance—than the No. 2 lot; but it has yet to be seen which lot of plants will succeed better when planted out. Nevertheless, it is very apparent that the application of slag on the seed-beds has had a marked effect on the constitution of the young plants. Even allowing that the seedlings were raised in different localities, there could scarcely have been such a difference in health and vigour had not the slag been used. J. BOYD.

WORKING-PLAN FOR THE ARDROSS WOODS.[1]

A working-plan for the above woods, which are the property of Mr C. W. Dyson Perrins, has just been drawn up by Dr Schlich and Mr R. S. Pearson. It contains valuable suggestions, most of which are applicable to other Highland estates; and it should be studied by all Scottish landowners, factors, and foresters. Special attention may be directed to what the authors say regarding the treatment of larch, in view of the prevalence of the destructive Larch Blister, and regarding the exotic species which they suggest for trial as forest-trees in this country. Among other matters may be mentioned their recommendation of the vertical notching-spade for the planting out of young seedling trees. F. B.

FORESTRY AT THE WEST OF SCOTLAND AGRICULTURAL COLLEGE.

A scheme calculated to afford a complete course of theoretical and practical instruction in Forestry has recently been devised

[1] London: Bradbury, Agnew & Co., 1907. Price 6d.

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by the West of Scotland Agricultural College, and owing to the kindness of certain proprietors, and the efforts of the Lorn District Committee of the County Council of Argyll, a most promising start has already been made.

The Lorn District Committee has promised to pay the class fees of six Forestry students, who are in the first instance to be apprenticed for eighteen months on certain estates, and are subsequently to attend a winter session at the Agricultural College in Glasgow.

The scheme includes the further advantage, that the methods of Forestry practised upon the properties where the students are engaged are made available to the College for the purposes of experiment and research.

Lord Strathcona, Mr Macalpine Downie, Mr Nelson and Mr Macdonald have all consented to a working arrangement of this kind with the College.

The conditions under which the students are appointed may be summarised as follows:—

The course is for working men and youths only. It will extend over a period of two years, during which time the students will be required to spend six months in Glasgow, taking classes of forestry, botany, chemistry, soils and manures, zoology, book-keeping, and surveying at the West of Scotland Agricultural College. The Forestry Experimental Station of the College at Kilmarnock will also be visited. Students will further be required to spend eighteen months on an estate where they will (1) perform the duties of a working forester; (2) keep a journal recording full details and costs of the work done each day (these journals will be taken into account in all examinations); and (3) attend such lectures and examinations as the College may decide to hold. The intention is to give weekly lectures at the local centres for a certain period of the year. For the present, the number of students to be admitted in any one year is limited to ten. Wages will be paid to the students during their work on the estates, their College fees will also be paid during their work in Glasgow, and assistance given towards their other expenses in Glasgow. It is also hoped that special bursaries may be established. Periodical examinations will be held in Oban and other centres, and at the end of the course certificates will be given to those who suceeed in satisfying the examiners. Applications for admission should be sent to

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Mr John D. Sutherland, Royal Bank of Scotland, Oban, and should be received before 30th September in any year.

W. F. A. H.

Forestry at the University of Edinburgh.

The University Court has established three additional lectureships in connection with the degree of B.Sc. in Forestry. Dr R. S. MacDougall will lecture on Forest Entomology, and Dr A. W. Borthwick on Forest Botany, while Mr Hudson Beare, Professor of Engineering, has consented to conduct the course in Forest Engineering, pending the appointment of a lecturer in that subject.

Chair of Forestry at Cambridge.

Mr Augustine Henry, M.A., F.L.S., a native of Derry, in Ireland, has been appointed Reader in Forestry at Cambridge. Mr Henry studied for two years at the Forestry School at Nancy, and has travelled extensively, having visited the forests of China, Japan, North America, France, Spain, Corsica, as well as those of Great Britain. He has also been associated with Mr H. J. Elwes, F.R.S., in the authorship of *The Trees of Great Britain and Ireland.*

Forestry Appointment at Inverliever.

The Commissioners of Woods and Forests have selected Mr John Boyd, Head Forester to Sir John Stirling-Maxwell on the Pollok Estate, as Resident Forester in the newly-acquired Government Forest of Inverliever. Mr Boyd is to be congratulated on his appointment to this important office, for which he is well qualified.

On Friday, 19th June, a presentation was made to Mr Boyd on the occasion of his leaving the Pollok Estate. The presentation took place at the Agricultural College in Glasgow, Principal Wright being in the chair. An Exhibition in connection with Forestry was held at the same time.

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Wood: Its Botanical and Technical Aspect.

A lecture with the above title was delivered by Professor Wm. Somerville, M.A., D.Sc., at the Royal Institution, London, on 20th February. The lecture was illustrated by a series of diagrams of wood and of tables showing comparative growths of different species of timber-trees.

The Cost of Fencing.

In connection with the subject of outlay on afforestation, one often reads or hears that planting costs so much per acre, and that some additional named sum, or some proportion of the planting charge, must be added to provide for fencing. Persons who give such rates doubtless quote from their own experience in fencing particular tracts, where the cost was actually as stated. But it is evident that such figures, however accurate they may be, cannot be generally applied, all fencing estimates given in the form of a constant rate per acre, or in that of a constant proportion to the planting charge, being fallacious.

The cost per acre of planting is not much affected by an increase or a decrease of the area stocked. If a contractor be employed, he charges a rate per acre which does not greatly vary with the area. But the cost of fencing works out very differently, as may be seen from what follows. Assuming the side of a square plot of ground covering one acre to be 70 yards, the length of a fence enclosing it will be (4 × 70) 280 yards, and the cost at 1s. a yard will be £14—that is, £14 per acre. Take a second square plot covering 4 acres, and it is clear that while the area has been increased four-fold, the length of the fence has only been doubled. And if the calculation be carried a little further, we arrive at the following results:—

Square Area Enclosed.	Length of Fence.	Cost.	
		Total.	Per Acre.
Acres.	Yards.	£	£ s. d.
1	4 × 70 = 280	14	14 0 0
4	8 × 70 = 560	28	7 0 0
16	16 × 70 = 1120	56	3 10 0
64	32 × 70 = 2240	112	1 15 0
256	64 × 70 = 4480	224	0 17 6
1024	128 × 70 = 8960	448	0 8 9

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and so on. A pretty wide range! Even at the rates found near the bottom of the table the burden of providing fences is heavy enough; but if the blocks of forest are large ones, it is not so heavy as it is often represented to be. If, however, the blocks are of irregular outline, or are elongated into the form of strips or shelter-belts, the cost of fencing will be much higher than that stated above, which has reference to square blocks only. Indeed, if the blocks be sufficiently irregular or elongated, the cost may be almost infinitely expanded.

It may therefore be assumed that, having regard to the bill for fencing, large, regularly shaped, and approximately square blocks are much to be preferred. And large blocks have the further great advantage that, as indicated by the proportionally shorter length of the fence required to enclose them, they carry a smaller proportion of ill-shapen, branchy, marginal trees; while the larger the area, the more do the conditions of moisture, temperature, and air-stillness in the interior approach those of a natural forest, and thus promote the healthy development of the crop. Again, in the case of large areas, work, being more concentrated, can be more efficiently supervised and more economically done; fewer roads for the removal of timber have to be kept up, while labour-saving mechanical means of transport may be more successfully employed; and, finally, the market can be better served, to the enhancement of sale prices.

On most estates woods are required for game coverts; and they answer this purpose better if they are not too large, and if they are more or less elongated rather than compact in shape. But on some estates, at least, it may be possible, after duly providing for sporting requirements, to devote considerable areas to the practice of systematic forestry, with profit as the object of management; and such areas should, as far as practicable, be laid out in large and compact blocks.

F. B.

Experimental Study of Larch Canker.

Mr E. R. Burdon, of the Botany School, Cambridge, proposes to organise an experiment on a large scale to test the theory that the *Chermes* bug is responsible for the majority of cases of Larch canker. In outline the experiment is as follows:— It is proposed to start in different parts of England and Scotland

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about a dozen plantations, each consisting of fifty *Larix europæa* and fifty *Larix leptolepis*. The plantations are to be established in the vicinity of other larch plantations already infected with canker, but are to be formed of young larches free alike from canker and from *Chermes*. Each plantation is to be divided into three parts: of these one will be kept free from *Chermes* by spraying, one will be artificially infected with *Chermes*, the third will be left without interference. The plantations are then to be carefully studied, and it is hoped that the results in ten years' time will yield some valuable information on the connection between *Chermes* and canker. A number of proprietors have already favourably received the suggestion that plantations should be started on their lands for the purposes of the experiment, but the constant periodical inspection which the experiment necessitates will involve a heavy outlay. Members of the Society who are interested in the subject are requested to communicate with Mr Burdon.

The Foresters' and Gardeners' Society of Argyll.

This Society has been established to stimulate and encourage the study and practice of Forestry and Gardening by regular meetings for discussion, and by such other means as may from time to time suggest themselves, and to assist members and their families as occasion may arise. It is composed of Honorary Members and Ordinary Members, consisting of (*a*) Proprietors, Factors, and others, (*b*) Foresters and Gardeners. A meeting of members is held once a month during six months of the year, a syllabus of subjects for discussion and lectures being drawn up by the committee. At least two outside excursions are also arranged during the year to woods and gardens in the district or elsewhere.

Some recent Forestry Books.[1]

Annesley, Earl, *Beautiful and Rare Trees and Plants.* 70 Illustrations from Photographs taken at Castlewellan. Net 42s. Newnes, 1903.

[1] See "Note on Modern Works on Forestry" in the *Transactions*, Vol. XV. The books in this additional list are also obtainable from Messrs Douglas and Foulis, 9 Castle Street, Edinburgh.

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BRANDIS, DIETRICH, *Indian Trees: An Account of Trees, Shrubs, Climbers, Bamboos, etc., indigenous or commonly cultivated in the British Indian Empire.* Net 16s. Constable, 1906.

BROWN, J. PINKNEY, *Practical Arboriculture: How to Plant and Grow Forest Trees which may be Grown in our Generation to a Profit.* Text-Book for Railway Engineers. 100 Illustrations (Connersville Arboriculture). Net 12s. 6d. Dawson, 1906.

CHARPENTIER, P., *Timber: Comprehensive Study of Wood in all its Aspects, Commercial and Botanical.* Translation from French by J. Kennell. Illustrated. Net 12s. 6d. Scott and Greenwood, 1902.

COLE, VICAT, *British Trees Drawn and Described.* 2 Vols. Net 34s. Hutchinson, 1907.

COOK, E. T., *Trees and Shrubs for English Gardens.* Illustrated. Net 12s. 6d. Newnes, 1902.

COX, G. C., *Royal Forests of England.* Illustrated. Net 7s. 6d. Methuen, 1905.

CURTIS, C. E., *Practical Forestry and its Bearing on the Improvement of Estates.* Third Edition. Net 3s. 6d. Lockwood, 1907.

DAME, L. L., and BROOKS, H., *Handbook of Trees of New England, with ranges through the U.S. and Canada.* Plates. Net 7s. 6d. (Boston), 1902.

ELWES, H. J., and HENRY, A., *The Trees of Great Britain and Ireland.* 5 Vols. Illustrated. Net £15, 15s. Quaritch, 1907.

FORBES, A. C., *English Estate Forestry.* Net 12s. 6d. Arnold, 1904.

GANT, A., *Seaside Planting of Trees and Shrubs.* Illustrated. Net 5s. Newnes, 1907.

GILLANDERS, A. T., *Forest Entomology.* Illustrated. Net 15s. Blackwood, 1908.

GREEN, S. B., Professor of Forestry, University of Minnesota. *Principles of American Forestry.* Net 6s. 6d. Chapman and Hall.

GROOM, PERCY, *Trees and their Life-Histories.* Illustrated. Net 25s. Cassells, 1907.

NISBET, JOHN, *The Forester: A Practical Treatise on British Forestry and Arboriculture for Landowners, Land Agents, and Foresters.* In 2 volumes. Net 42s. Blackwood, 1905.

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SARGENT, C. S., *Manual of Trees of North America (exclusive of Mexico)*. Net 25s. Constable, 1905.

SCHLICH, Professor, *Forestry in the United Kingdom*. (A Lecture.) Net 2s. Bradbury, 1904.

SCHLICH, Dr, *Manual of Forestry*. Vol. I., "Forest Policy in the British Empire." 3rd Edition revised. Net 6s. Bradbury, 1906.

——— Vol. II., "Sylviculture." 3rd Edition revised. Net 8s. 1904.

——— Vol. III., "Forest Management." 3rd Edition revised. Net 9s. 1905.

——— Vol. IV., "Forest Protection," by W. R. FISHER. 2nd Edition. Net 12s. 1907.

SCHWAPPACH, Dr, *Primer of Forestry*. Translated by FRASER STORY. Net 1s. Dent, 1904.

SIMPSON, J., *Game and Game Coverts*. Illustrated. Net 15s. Country Gentlemen's Association, 1906.

SIMPSON, John, *The New Forestry, or the Continental System adapted to British Woodlands and Game Preservation*. Illustrated. Net 15s. Pawson & Brailsford, 1907.

STEP, E., *Wayside and Woodland Trees: Pocket Guide to British Sylva*. Illustrated. 6s. Warne, 1904.

STONE, HERBERT, *The Timbers of Commerce and their Identification*. Illustrated with 186 Photo-Micrographs. Net 7s. 6d. Rider, 1904.

Trees and Shrubs grown in the Kew Arboretum, excluding Coniferæ. Hand List. Net 1s. 3d. Kew Gardens, 1903.

UNWIN, A. HAROLD, *Future Forest Trees, or the Importance of the German Experiments in the Introduction of North American Trees*. Net 7s. 6d. Unwin, 1905.

WARD, H. MARSHALL, *Trees: Handbook of Forest Botany for Woodlands and Laboratory*, Vol. I., "Buds and Twigs." Vol. II., "Leaves." Vol. III., "Flowers and Inflorescences." Each net 4s. 6d. Cambridge University Press, 1904-5.

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REVIEWS AND NOTICES OF BOOKS.

Forest Entomology. By A. T. GILLANDERS, F.E.S., Wood Manager to the Duke of Northumberland. xxii + 422 pp., including Index. 351 Illustrations. Blackwood & Sons, Edinburgh, 1908. Price 15s.

Some years ago, at one of the dinners of the Royal Scottish Arboricultural Society, the cover of the menu card, skilfully drawn, showed a German forester driving injurious insects out of his wood at the sword's point, a British forester being depicted lying asleep and unconcerned while the insects attacked his trees. If the artist wished to convey the lesson that more took place in the wood while the forester slept than the "growing of the tree" in the Society's motto, and that it behoved the forester to be on the alert against insects, we can declare, with perfect certainty, that the reproach has lost much of its point, for the importance of the study of Forest Entomology is now widely recognised. That our foresters only need some encouragement to make good use of their opportunities has been well proved true by numerous and useful notes and articles on entomological subjects which have recently appeared in the *Transactions* of the Society. And now we have, in this book of Mr Gillanders, the latest proof of the advantage of, and interest in, the subject of Forest Entomology.

Chapter I. gives a résumé of the Eriophyidæ or Gall Mites, the various species of importance in Forestry being described in detail. The next two chapters treat of the Beetles, these extending, as the importance of the order warrants, to almost one hundred pages. Chapter IV. treats of Oak Galls, and Chapter V. of other harmful Hymenopterous Insects—the Sawflies and the Wood Wasps. Chapter VI. treats of Scale Insects; Chapter VII. of Moths; Chapter VIII. of Aphididæ; Chapter IX. of Diptera; Chapter X. of Psyllidæ and Cicadidæ; while concluding chapters give hints on collecting, on Insecticides and on Beneficial Insects.

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In each case abundant detail is set forth. The student of forest entomology, and especially the working forester, will find in the book a mass of material largely drawn from the eminent authors cited, whose works are not always easily accessible, while he cannot fail to be impressed with the enthusiasm of the author for his subject, and with the assiduity and industry he has displayed in the production of his book. To break ground in Britain with a new text-book on Forest Entomology was no easy task. Mr Gillanders deserves, and will receive, the warmest acknowledgment of his efforts. The book is illustrated with numerous figures, some of them very good. To say that Messrs Blackwood are the publishers is to say that nothing is wanting in the get-up.

Trees and Their Life-Histories. By PERCY GROOM. London: Cassell & Co. Price 25s. net. With 512 Illustrations.

This book forms a most welcome addition to the literature of Forest Botany. The author has been very successful in his endeavour to place before the reader a simple and clear account of the life and growth of the various forest-trees with which he deals. The volume is lavishly illustrated by typical and well-chosen photographs showing the trees as they appear at different seasons of the year, and also the characteristic features of their various parts, such as bud, flower, fruit, leaf, twig, root, and bark.

The trees dealt with are treated under the two classes Gymnospermæ and Dicotyledones. In his Introduction Professor Groom has given a very interesting organographical description of the different parts which compose the tree. He has evidently taken pains to write this Introduction in such a way that the non-botanical reader might have no difficulty in understanding clearly, and appreciating the importance to the tree of its various organs, and thus to profit by what follows. In the other two parts of the volume the individual life-histories of the two great classes of trees are given. In describing the special life-history of each tree, no point of importance has been omitted, and the written account, together with the photographs given to illustrate the various points, present to the student a complete picture of the different phases through which the tree passes in its growth

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and development from the embryo to maturity. Of course, in a book of this size it is impossible to include all known species, but the author has made a judicious selection of the trees most likely to be met with in our various forests and parks.

The author has never lost sight of the fact that the living tree is the object upon which the reader's attention must be focussed, and this he has succeeded in doing in a very successful manner.

We can confidently recommend this book to all who are interested in trees.

Webster's Foresters' Pocket Diary (Sixth Edition) *for* 1908, *for the use of Foresters, Estate Agents, Nurserymen.* 2s. 6d. net. London: William Rider & Son, Ltd.

The present issue of this little pocket-book, which is of a convenient size and made of good paper, shows the same features as former editions, and has also some new articles in the introductory portion. These include some Tables useful to foresters, a note on the Area of Woodlands in Great Britain and Europe, some statistics in regard to the Average Prices of Home-grown Timber, and so forth. The present issue is likely to prove as useful to foresters as have the former editions.

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Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1907—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Royal Scottish Arboricultural Society was held in the General Meeting Room in the Highland and Agricultural Society's Showyard, Prestonfield, Edinburgh, on Thursday, 11th July 1907, at 11.30 A.M. In the unavoidable absence of Sir KENNETH MACKENZIE, Bart., President of the Society, Sir JOHN STIRLING-MAXWELL, Bart., Vice-President, occupied the Chair. There was a large attendance of Members.

MINUTES.

The Minutes of the Annual Meeting, which had been printed and circulated amongst the Members along with the *Transactions*, were held as approved.

CHAIRMAN'S REMARKS.

The CHAIRMAN said that all the Members would regret to hear that the cause of the President's absence was the illness of his daughter, and that he was sure they would authorise him to write to the President expressing their sympathy with him in the circumstances. He was also confident that the

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Members would join with him in thanking the Highland and Agricultural Society for the grant of £20 which they had given for prizes for timber exhibits, for the free space which they had given to the Society, and for the use of the room for the present meeting. The Society's Exhibition was not on a very large scale, but it was a very interesting one, and represented the nucleus of what would be a very large development on the same lines as the years went past. The number of estates in Scotland which cared to compete was small, but was increasing, and as time went on there was no doubt the Exhibition would become one of considerable national importance.

Election of Honorary Members.

On the motion of the Chairman, the following were elected Honorary Members of the Society, as recommended by the Council, viz.:—(1) Frederick Simmonds, M.V.O., 16 Abingdon Court, Kensington West, late Deputy Surveyor of Windsor Parks and Woods; and (2) The Right Honourable Lord Castletown of Upper Ossery, K.P., C.M.G., Granston Manor, Abbeyleix, Ireland, President of the Irish Forestry Society, and Chancellor of the Royal University of Ireland.

Inverness Branch.

It was reported that, in terms of the requisition referred to in the last Annual Report of the Society, a meeting of the Members residing in Inverness district had been held in Inverness on 4th May 1907, which was attended by the President, the Honorary Secretary, and the Secretary on behalf of the Council, when the Branch was duly constituted, and the following Office-Bearers were elected:—*President*—Mr J. Grant Thomson, Wood Manager's Office, Seafield Estates, Strathspey. *Vice-Presidents*—Lord Lovat and Brodie of Brodie. *Committee*—James Gossip, Nurseryman, Inverness; Donald Robertson, Forester, Dunrobin; Daniel Scott, Forester, Darnaway; James Walker, Wood Merchant, Inverness; Gilbert Brown, Forester, Beaufort; and John J. R. Meiklejohn, Factor, Novar. *Hon. Secretary and Treasurer*—Alex. Fraser, Solicitor, Inverness.

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Forestry Exhibition.

The Secretary then intimated the Judges' Awards in connection with the Forestry Exhibition in terms of the following Report, viz.:—

Report by the Judges on the Forestry Exhibition held within the Highland and Agricultural Society's Show-ground at Edinburgh from 9th to 12th July 1907.

We beg to submit our awards as follows:—

I. Articles in Competition.

Competition No. I.

For Boards of Scots Pine, Larch, and Norway Spruce.

1st Prize,	£2, 10s.,	The Earl of Mansfield.
2nd Prize,	£1, 10s.,	John A. Stirling of Kippendavie.
3rd Prize,	£1,	The Duke of Roxburghe.

Competition No. II.

For Boards of any three Coniferous Timber Trees other than the above.

1st Prize,	£2, 10s.,	The Earl of Mansfield.
2nd Prize,	£1, 10s.,	H. J. Younger of Benmore.

Competition No. III.

For Boards of Ash, Oak, and Elm.

1st Prize,	£2, 10s.,	Captain Stirling of Keir.
2nd Prize,	£1, 10s.,	The Earl of Mansfield.
3rd Prize,	£1,	Sir Duncan E. Hay, Bart. of Smithfield and Haystoun.

Competition No. IV.

For Boards of any Three Broad-leaved Trees, other than the above.

1st Prize,	£2, 10s.,	Sir Duncan E. Hay, Bart.
2nd Prize,	£1, 10s.,	The Earl of Mansfield.
3rd Prize,	£1,	H. J. Younger of Benmore.

Competition No. V.

For Specimens of the Fruits of Trees, together with Drawings or Photographs showing the Morphological Structure of Fructification in each particular species.

John Patten, Jun., Hulne Park, Alnwick, ... } No. 1 Silver Medal.

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Competition No. VI.

Damage done by Insect Pests.

The Duke of Roxburghe, . No. 2 Silver Medal.

Competition No. VII.

Gate for Farm Use manufactured from Home-grown Timber.

The Earl of Mansfield, . . No. 1 Silver Medal.

Competition No. VIII.

Self-closing Wicket-Gate manufactured from Home-grown Timber.

The Earl of Mansfield, . . No. 1 Silver Medal.

Competition No. X.

Full-sized Section of Rustic Fence made from Larch or other Thinnings.

Alex. Pollock, Tarbolton, . Bronze Medal.

Competitions Nos. XI., XII.

Specimens showing the Comparative Quality of Larch and other Timbers grown on different Soils and Situations, and the respective Ages at which they reach Marketable Size and Maturity.

The Duke of Roxburghe, . No. 1 Silver Medal.

Competition No. XIII.

Specimens illustrating the Beneficial Effects of Pruning when well done, and the Injurious Effects when badly done.

The Duke of Northumberland, No. 2 Silver Medal.

Competition No. XIV.

Specimens of Stems illustrating the Effects of Dense and Thin Crops in Branch Suppression, and Quality of Timber.

The Duke of Northumberland, No. 2 Silver Medal.

Competition No. XV.

Examples showing the Best Methods of Utilising Home-grown Small Wood, to be accompanied by specimens of round wood.

The Earl of Mansfield, . . No. 2 Silver Medal.
Alex. Pollock, Tarbolton, . Bronze Medal.

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Competition No. XVI.

Collection of Fungi injurious to Forest Trees and Shrubs.

W. Steuart Fothringham of Murthly, ... } No. 2 Silver Medal.

Competition No. XVII.

Examples or Photographs of Damage caused by Squirrels, Voles, etc.

The Duke of Roxburghe, . Bronze Medal.

Competition No. XVIII.

For any Useful Invention or Marked Improvement on any of the Instruments or Implements used in Forestry.

The Duke of Roxburghe, . No. 1 Silver Medal.

Competition No. XIX.

For any approved Article either wholly or mainly made of Wood.

William Sinton, Jun., Jedburgh, Bronze Medal.
Alex. Pollock, Tarbolton, . Bronze Medal.

II. Articles for Exhibition only.

In giving effect to the instructions of the Committee, that in the event of an Exhibit of special merit being brought forward, the Judges may recommend one of the Society's Medals or other Award, we beg to recommend Awards as follows:—

To Dr A. W. Borthwick, Hon. Cryptogamist to the Society, for his valuable and extensive Exhibit of the Cones and Branchlets of Conifers, dried and mounted in cases; and for his specimens of New and Undetermined Species of Fungi—a Gold Medal.

To A. T. Gillanders, F.E.S., Alnwick Castle, for his specimens of Plants, Trees, and Timber damaged by Insects, and specimens of the Insects which caused the damage; and for examples of Turf and Soil, illustrating the advantage of pasturing woodland or waste-land by stock, previous to planting—a No. 1 Silver Medal.

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To the Earl of Mansfield, for his specimens illustrating the Rate of Growth of Trees, with statement of Age and Volume per acre; Hunting Wicket-Gate; and a collection of Tools used in Forestry Operations—a No. 1 Silver Medal.

To Alexander Murray, Forester, Murthly, for his collection of the Seeds and Leaves of 180 varieties of Trees and Shrubs—a No. 2 Silver Medal.

To Messrs Dicksons & Co., Nurserymen, Edinburgh, for a collection of Tools used in Forestry; collection of Cones; and a collection of Timbers shown as hand specimens—a No. 2 Silver Medal.

To Adam Spiers, Timber Merchant, Edinburgh, for specimens, in large size and exceptional quality, of Oak, Sycamore, Larch, etc.—a No. 2 Silver Medal.

The Judges have pleasure in reporting that on this occasion the exhibits, both as regards quality and numbers, showed a distinct advancement on most of the Exhibitions preceding it. The quality of the timber in the various Competitions left little to be desired, and the sawing and handling of the boards showed that the Exhibitors had profited by the experience gained at former Exhibitions.

In Competition No. I. the evenness in quality and size of the boards of Scots Pine, Larch, and Norway Spruce had not been excelled at any previous Exhibition, and the Judges had considerable difficulty in arriving at their decision.

In Competition No. III. the Timber was of excellent quality also, and if a weakness showed at all, it was in the quality of the Ash—a slight tendency towards discoloration being noticeable in all the specimens.

In Competition No. XVII., although the Photographs of the Forest Tramway and accompanying Report showed no new invention or special improvement on existing appliances of the kind, the Judges, in consideration of the wide applicability of this method of haulage in large forest areas, the value of the Photographs and of the Report, were unanimous in their recommendation of a No. 1 Silver Medal.

In the Classes for Field and Wicket-Gates there was a notable increase in the number of entries, and both as regards design and make up they were of a substantial and serviceable nature. As there is always considerable diversity in the weight of mountings and timbers used in construction, the Judges beg to recommend that in future a detailed account should accompany each exhibit, showing the weight and cost of iron mountings, and of the timber forming the gate and the gateposts, so as to admit of a closer comparison of the cost stated by Exhibitors.

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It is to be regretted that landowners and their foresters resident within the Show area should not have taken a greater practical interest in the Exhibition. Every estate cannot possibly be possessed of timber of size and quality sufficient to ensure a high place in the Prize List, but the list of Competitions has been so arranged that all possessed of a desire to help may be enabled to do so. The national aspect of the Exhibition must of course be preserved, but it is especially desirable that each locality should be strongly represented by its own products.

The general arrangement and staging of the exhibits reflected the greatest credit upon the Exhibition Committee, who, ably directed by Mr MacHattie, their Convener, had the exhibits so placed that the work of the Judges was greatly simplified.

JOHN D. CROZIER.
JOHN BROOM.
S. MACBEAN.

The SECRETARY reported that the Council had unanimously approved of the Judges' recommendations, and the awards and recommendations were accordingly approved by the Meeting. Mr JOHNSTONE moved the adoption of the Report, and expressed the indebtedness of the Society to the Judges, and also to the Exhibition Committee, to whom, on his motion, a hearty vote of thanks was accorded. The SECRETARY then moved a vote of thanks to Mr Pollock for so kindly granting the use of one of his rustic houses for an office during the Exhibition. He also mentioned all those who had sent articles for exhibition, but had obtained no award, and particularly referred to Mr Weale, whose collection of Photo-Micrographs had carried off the Society's Gold Medal last year, and to Mr David W. Thomson, Nurseryman, Edinburgh, who so kindly sent the ornamental trees and shrubs.

JUDGES' REPORT ON ESSAYS.

The Report of the Judges on the Essays received in Competition was given by the SECRETARY as follows, viz. :—

CLASS I.

(1) The Best Method of Disposing of Refuse Wood after Felling.

Award—Bronze Medal, to WILLIAM HALL, The Terrace, Tockwith, near York.

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(2) Hedge Laying.

Award—Bronze Medal, to WILLIAM HALL, The Terrace, Tockwith, near York.

(3) The Laying Out of a Mixed Plantation, and its Management for the next Twenty-five Years.

Award—No. 1 Silver Medal, to W. H. WHELLENS, Gregynog, Newton, North Wales.

(4) Collection of Ten Notes of Silvicultural Interest.

Award—No. 2 Silver Medal, to THOMAS HALL, Moore Abbey, Monasterevan, Co. Kildare.

CLASS II.

(1) The Nursery Treatment of the Western or Californian Hemlock Spruce (*Tsuga Mertensiana*), with Notes on its Suitability for use as a Forest Tree.

Award—No. 2 Silver Medal, to J. M. MURRAY, Assistant Forester, 26 Colville Place, Edinburgh.

The Report was approved. Mr Massie moved a hearty vote of thanks to the Judges for their trouble in connection with the Essays, which was duly responded to.

EXCURSION 1907.

Mr BUCHANAN, Convener of the Excursion Committee, reported that a considerable number of names had already been entered for the forthcoming Excursion, and that he hoped a good representation of all classes of Members would visit Strathspey next month. He said that three places had been mentioned for the Excursion next year, viz.—Germany, Lochiel's country, and the Edinburgh district, and that the Council had unanimously agreed to recommend the Edinburgh district, in view of the fact that the Scottish National Exhibition is to be held in Edinburgh next year. He moved that they decide on the Edinburgh district, and this was unanimously agreed to. The date of the Excursion was then considered. Mr Whitton pointed out that the date usually fixed on interfered with the work of foresters and gardeners immediately previous to the 12th of August, while, again, the middle of July was unsuitable owing to the Highland Show. It was ultimately agreed that each Member should send his views on the subject to the Secretary.

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Scottish National Exhibition, 1908.

Mr W. H. Massie, Convener of the Committee on this Exhibition, which is to be held in Edinburgh next year, said that the Council of the Society thought it advisable to take advantage of the opportunity of bringing the interests of forestry before the public at the Exhibition. The Committee had had a meeting with the Manager, who led them to understand that the Exhibition authorities would be only too pleased to give the Society a place. The Council had asked all the Members in their recent circular to intimate what exhibits they were likely to send, and after the replies had been received, they would know what course to pursue.

Newly Discovered Fungi.

The Chairman mentioned that Dr Borthwick's exhibit included three newly-discovered fungi, and, at his request, Dr Borthwick explained these to the meeting. The President thanked Dr Borthwick for his interesting statement.

Dr Somerville's Address.

The Secretary explained that, owing to an unavoidable cause, Dr Somerville was prevented from attending the meeting and delivering his address on "Heredity and Forestry," but that he had sent his MS., which would be read by Dr Borthwick. Dr Borthwick then read the address, which it was agreed should be printed in the *Transactions*.

Mr Charles Buchanan said the Members were sorry to know that Professor Somerville had been unable to attend the meeting, but they hoped to have him with them in the course of the forthcoming Excursion, when doubtless there would be an opportunity of talking over the various points raised. He moved that they record their obligation to Dr Somerville for sending his valuable paper, and that the Secretary be instructed to thank him for it. He also moved a hearty vote of thanks to Dr Borthwick for reading the paper to them.

A vote of thanks to the Chairman, proposed by Mr Whitton, closed the proceedings.

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Royal Scottish Arboricultural Society.

SYLLABUS OF COMPETITIONS—1908.

[*The Judges are empowered to fix the value of the Prizes to be awarded according to the respective merits of the Essays.*

All Essays, Reports, Models, or other Articles intended for Competition must be lodged with the Secretary not later than 15th May 1908. Each such Essay, Report, Model, or Article must bear a MOTTO, *and be accompanied by a sealed envelope bearing outside the* SAME MOTTO, *with the Class to which the Competitor belongs, and containing a* CARD *with the* NAME *and* ADDRESS *of the Competitor.*

Essays should be written on one side of the paper only; the left-hand quarter of each page should be left as a blank margin. The lines should not be crowded together.

Judges cannot compete during their term of office.

Successful Competitors may have either the medals or their converted values, which are as follows:—Gold, £5; No. 1 *Silver,* £3; No. 2 *Silver,* £2; *Bronze,* 10s.]

The following subjects are named for competition in 1908:—

CLASS I.—FOR OPEN COMPETITION.

I. An account of the Broad-leaved and Coniferous Trees, especially of the more recently introduced Species, which the writer has found from experience to be most suitable as Forest Crops on high and exposed situations. The method under which such a Crop has been raised to be fully described. (*Five Guineas* offered by W. H. MASSIE, Esq., of Messrs Dicksons & Co., Nurserymen, Edinburgh.)

II. Suitability of any exotic Conifer for cultivation as a Forest Crop, and nature of the locality found, in the experience of the writer, to be most suitable for it. (*Five Guineas* offered by DAVID W. THOMSON, Esq., Nurseryman, Edinburgh.)

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III. The relative powers to bear shade of some or all of the following species:—Douglas Fir, Menzies Spruce (*Picea sitchensis*), White American Spruce, *Sequoia Sempervirens*, Lawson's Cypress, *Abies grandis*, Giant Hemlock (*Tsuga Mertensiana*), *Thuya gigantea*; and the order in which the above Species should be placed in a list of shade-bearing trees comprising also Silver Fir, Beech, Spruce, Hornbeam. The Report to be based on personal experience only. (*Five Guineas* offered by JOHN METHVEN, Esq., of Messrs Thomas Methven & Sons, Nurserymen, Edinburgh.)

IV. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop by the method of "Direct" Sowing. The conditions of Soil and Soil Covering to be fully stated. (*A Medal.*)

V. Comparative results obtained by various methods of Planting, with various Species and Sizes of Plants, up to the time at which the Young Plantation has become thoroughly established. (*A Medal.*)

The Report to be based on actual experience; soil and other local conditions to be fully described.

VI. The use, on an Estate with which the writer is, or has been, connected, of Timber of any British-grown exotic Conifer, for House Carpentry and other Estate purposes. (*A Medal.*)

Besides giving information as to the specific uses to which the timber has been put, the writer should give details, such as the age of the trees from which it was taken, the soil on which they were grown, and whether the trees were raised in the open, or in woods of ordinary density. Statistics to be given, as far as available, of the comparative durability of this timber and the timber of British coniferous trees.

VII. Details of Measures successfully adopted, on an Estate with which the writer is, or has been, connected, to prevent or mitigate the destructive effects of Gales. (*A Medal.*)

VIII. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop in a frosty locality, with details as to Soil Covering, Species, and Measures of Protection adopted. (*A Medal.*)

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IX. An approved Report on the Woods of which the competitor is Forester. Reporter to state the extent of the woods, the species of trees grown, soil, situation, age, management, etc. (*A Medal.*)

X. Successful Under Planting of Larch or other Light-crowned Species, on an Estate with which the writer is, or has been, connected. (*A Medal.*)

The Report to be based on experience, the cases referred to being cited.

XI. Details of Measures successfully practised by the writer to exterminate any important Parasitic Fungus, or to mitigate the Damage done by it. (*A Medal.*)

XII. Details of Mechanical means employed by the writer, or on the Estate with which he is connected, for moving Timber from the interior of Woods to their margins, or to roads. (*A Medal.*)

XIII. The erection and maintenance of a Saw-mill, or any Wood-working Machinery, used by the writer, or on the Estate with which he is connected, for the Manufacture of Timber, with details of outturn and cost. (*A Medal.*)

XIV. Details of Measures successfully adopted for the natural regeneration of a timber crop of Scots Pine, Larch, or other species. (*A Medal.*)

XV. For an approved Essay on the Botanical characteristics of typical Coniferæ. The Essay to be accompanied by Illustrations, and to be of an educational character. (*A Medal.*)

XVI. For an approved Essay on Soils:—(*a*) preparation prior to planting; (*b*) the advantages of soil-protection accruing from density of crop; (*c*) the improvement to the soil arising from mixing the main crop with various classes of shade bearing trees. (*A Medal.*)

XVII. The best collection of ten short Notes of silvicultural interest based on personal observation. (*A Medal.*)

XVIII. An approved Essay or Report on any other subject connected with Forestry. (*A Medal.*)

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CLASS II.—FOR ASSISTANT FORESTERS ONLY.

I. Details of the Measures successfully practised by the writer to exterminate any important Insect Pest, or to mitigate the Damage done by it. (*A Medal.*)

II. The best collection of five Notes of silvicultural interest based on personal observation. (*A Medal.*)

III. An approved Essay or Report, based on personal experience, on any practical work connected with Forestry. (*A Medal.*)

ROBERT GALLOWAY,
Secretary.

5 ST ANDREW SQUARE,
EDINBURGH,
October 1907.

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Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

Patron—HIS MOST GRACIOUS MAJESTY THE KING.

LAWS OF THE SOCIETY.

1. FUNDAMENTAL LAWS.

I. The name of the Society shall be the "ROYAL SCOTTISH ARBORICULTURAL SOCIETY."

II. The objects of the Society are,—the advancement of Forestry in all its branches; including the institution of Schools of Forestry and Demonstration Areas, and the dissemination of a knowledge of such branches of Science and Arts as are connected with Forestry. These objects are proposed to be attained—

1. By holding meetings for discussion and the interchange of information; also for the reading of papers and abstracts or reviews of works bearing upon the objects of the Society.

2. By publishing annually, or oftener, *Transactions* and *Proceedings*, and an Abstract of the Accounts and Funds of the Society; also by publishing or circulating periodical or other literature containing information regarding Forestry.

3. By contributing to the formation, in Edinburgh or elsewhere in Scotland, of a Museum of British and Foreign Woods, of Forest Produce, and of objects relating to the science and practice of Forestry; also of a Forest Library.

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4. By encouraging the cultivation of all trees and shrubs which are suitable for the climate of Britain, with the view of facilitating the study of their uses and habits, and their climatic and other requirements.

5. By authorising, directing, assisting, and encouraging excursions, exhibitions, experiments, and investigations connected with Forestry or kindred sciences, to be undertaken in any part of Britain or abroad.

6. By appointing Correspondents residing abroad; and by appointing Local Secretaries in suitable home districts from amongst the Members of the Society, to co-operate with the Secretary and Officials in Edinburgh in the interests of the Society.

7. By advising and consulting with, or assisting financially or otherwise, any organised body giving instruction in Forestry on an approved method; by taking an active interest in examinations in Forestry, and by offering in competition bursaries to Forestry Students.

8. By establishing, in such centres as the Council may approve, Local Branches for the purpose of promoting the objects of the Society, upon such conditions as to Membership and otherwise as the Council may from time to time determine.

9. By keeping a Register of men qualified in Forestry, or in forest and estate Management, and by introducing such to employers.

10. By any other means that the Council may deem necessary or expedient from time to time.

III. The Society shall consist of three Orders, viz.: *Honorary* Members, *Ordinary* Members, and *Honorary Associate* Members. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible

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for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and others, subscribing annually .	One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually .	Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant-Farmers, and others, subscribing annually . . .	Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually	Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance.** *A new Member's subscription is due on the day of election, unless otherwise provided, and he shall not be enrolled until he has paid his first subscription.*

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the Meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to Class, of the following sums:—

1. Large Proprietors of land, and others, . . .	£10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and others, ...	5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, ...	3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

VIII. All Annual Subscriptions and payments for Life Membership shall be paid direct to the Treasurer.

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IX. The Society may, on the recommendation of the Council, elect *Twelve* British *Honorary* Members (including Indian and Colonial) and *Twenty* Foreign *Honorary* Members, —persons who have acquired eminence in Forestry at home or abroad, or who are otherwise deemed worthy. The Society may also, on the recommendation of the Council, elect *Honorary Associate* Members; but an *Honorary* Member or an *Honorary Associate* Member, who has not been elected from the list of *Life* or *Ordinary* Members of the Society, shall not be eligible for election as an Office-Bearer in the Society, and shall not vote at any of its meetings.

X. The Society may accept, from time to time, donations to its Property and Funds, Library and Museum, also Premiums to be awarded for the furtherance of any of its objects.

XI. The Funds of the Society shall, with the concurrence of the Council for the time being, be invested in such Trust security or securities as they shall approve, and shall be held in the names of three Trustees for behoof of the Society.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

XIII. The Council, by a two-thirds majority, and with the approval of the President, shall have power to expel any Member for any cause which shall appear to a meeting of the Council to require such action; it shall not be necessary for the Council to assign any reason for such expulsion, and all persons so expelled shall thereupon cease to be Members, and to have any interest in the Society or its concerns.

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XIV. The affairs of the Society shall be conducted by a President, six Vice-Presidents and twenty-one Councillors, with Secretary, Treasurer, and Auditor; provided always that nothing herein contained shall prevent the same person being appointed both Secretary and Treasurer. The President, Two Senior Vice-Presidents, Seven Senior Councillors, Secretary, Treasurer, and Auditor shall retire annually; but the President, one of the retiring Vice-Presidents, and four of the retiring Councillors, the Secretary, Treasurer, and Auditor shall be eligible for re-election. The other vacancies shall be filled by the election of eligible Members of the Society. Every member who has filled the office of President shall be eligible for election by the Council as an Honorary Life Member of the Council.

XV. The Annual Business Meeting of the Society shall be held at such time and place as the Council may determine, for the election of Office-Bearers, the hearing of the Secretary's, Treasurer's, and Auditor's Reports, and the transaction of other appropriate business. At this Meeting the following Honorary officials may be elected, viz., Honorary Secretary, Honorary Editor, Honorary Consulting Botanist, Honorary Consulting Chemist, Honorary Consulting Cryptogamist, Honorary Consulting Entomologist, Honorary Consulting Geologist, and Honorary Consulting Meteorologist. The Honorary Secretary and the Honorary Editor shall be members of the Council *ex officio*.

XVI. A General Meeting of the Society shall also be held in the course of each year — the time and place to be fixed by the Council—at which necessary business shall be transacted, and Subjects approved by the Council may be discussed. It shall be in the power of the President, or in his absence of the Senior Vice-President, to convene a Special General Meeting of the Society at any time, and the Council shall have power to call other General Meetings from time to time as occasion may require.

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XVII. An Extraordinary General Meeting of the Society may be called at any time, upon ten days' notice, by authority of the Council, on the requisition of Forty Members of the Society, who shall state precisely the objects for which they wish such Meeting to be summoned. The Special Business to be brought up shall be stated in the billet calling the Meeting, and it shall not be competent to introduce or discuss any other subject or business at such Meeting. Such Special Business shall not be considered as approved by the Society until the same shall have been confirmed by a two-thirds majority of the Members present and voting at the next Annual Business or General Meeting.

XVIII. The Council shall have the right at any time to claim a vote of the entire Membership of the Society on any subject brought before any Meeting of the Society.

XIX. At Meetings of the Society, no Motion or Proposal (except of mere form or courtesy) shall be entertained for immediate consideration, unless notice thereof has been given fourteen days previously to the Council; without prejudice, however, to the competency of proposing to remit such Motion or Proposal to the Council for consideration, with a view to its being disposed of at a future Meeting.

XX. The Council may appoint Correspondents residing abroad, and Local Secretaries in suitable home districts, but such appointments must be confirmed at the first General Meeting of the Society held thereafter. These appointments shall not confer a right to vote at any Meeting of the Society or Council.

XXI. Any proposal or motion for the alteration or amendment of the existing Fundamental Laws, or for the enactment of new Laws, shall be intimated in writing at the Annual Business Meeting, or at the General Meeting, but shall lie over for discussion till the next Meeting, which may be held not less than three months after such notice has been given as aforesaid. It shall then be decided on by a

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majority of at least two-thirds of the votes of *Life* and *Ordinary* Members present, provided at least thirty Members are present and vote. Such motion shall be clearly stated in the billet calling the Meeting at which it is to be discussed.

XXII. The Council shall have power to make such Rules, Regulations, or By-Laws as they may deem necessary or useful for the regulation of the affairs of the Society; and, from time to time, to vary, alter, or revoke such By-Laws; provided that no By-Law hereafter to be made, and no alteration or repeal of any By-Law, shall be considered to have passed and be binding on the Society until it has been adopted or confirmed, with or without modification, at a Meeting of the Society.

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2. BY-LAWS.

I. At any Meeting of the Society the Chair shall be taken by the President, but in his absence one of the Vice-Presidents or the Senior Member of Council present shall preside. Thirty Members shall form a quorum.

II. The Chairman shall have a deliberative and a casting vote.

III. The voting, upon all occasions, except as specially provided for in Laws XVII. and XXI., shall be, in the option of the Chairman, either by a show of hands or *numeratim*, *i.e.*, the Chairman shall ascertain the majority of the votes of *Life* and *Ordinary* Members present.

IV. In electing Office-Bearers, the Council shall recommend to the Annual Business Meeting the names of Members eligible to fill the vacancies. Such names shall be intimated to each Member in the billet calling the Meeting. It shall, however, be in the option of any Member present, to propose to substitute

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any other name or names, in lieu of any of those recommended. In the event of this being done, and a seconder to the new proposal being found, the vote shall be taken, as between the name or names thus proposed, and those proposed by the Council.

V. Any casual vacancy occurring in the list of Office-Bearers may be filled up by the Council, and the Office-Bearer thus elected shall take the place in the list, of the Office-Bearer whose vacancy he fills, and shall retire at the time that the latter would have done. *An Office-Bearer who shall not have attended a Meeting of the Council for one year —unless prevented by ill-health—shall be held to have vacated office.* Office-Bearers may obtain, on request, repayment of third class railway fares paid by them in attending Council Meetings.

VI. The Council shall have power to make conditions and regulations in connection with Competitions, Exhibitions, Experiments, Investigations, and all other matters undertaken with the view of promoting the objects of the Society; and also power to appoint Committees, Judges, or other Officials in connection therewith, except where otherwise specially provided.

VII. The Council, by a two-thirds majority of its Members present at the Meeting, and with the approval of the President, shall have power to limit the numbers who may attend the Excursions, and to reject any application for admission to these Excursions, without assigning any reason therefor.

VIII. The Judges of essays and other subjects proposed for competition are, during their term of Office, debarred from themselves competing.

IX. Intimation of all papers intended to be brought before the Meetings of the Society must be given to the Secretary, for the approval of the Council, at least one month previous to the Meeting at which they are to be read. Essays and

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Reports intended for competition, and Specimens, Implements, or other Articles intended for Competition, Exhibition, or Approval, must be submitted to the Society, in such manner and within such time as the Council may from time to time determine.

X. Any Member may transmit to the Secretary papers and communications, which, if approved of by the Council, may be read by the author, or, in his absence, by the President, Secretary, or other official at any Ordinary Meeting of the Society.

XI. Any Member who may be awarded a Medal or Premium by the Society shall have it in his option to receive the value in money or plate; and in the event of his selecting any other article than a Medal, it shall be competent for him to adopt and use upon it the inscription which would have been engraved on the Medal.

XII. The converted values of the Society's Premiums shall be—Gold Medal, Five Pounds; No. 1 Silver Medal, Three Pounds; No. 2 Silver Medal, Two Pounds; No. 3 Silver Medal, One Pound; Bronze Medal, Ten Shillings.

XIII. Local Secretaries shall act in the interests of the Society in their respective districts in securing new Members, and in disseminating information regarding the Society, for which purposes they shall correspond with the Secretary and Officials in Edinburgh; but they shall not be called on to collect the Subscriptions of Members.

XIV. Every Member of the Society shall have the privilege of bringing with him to the Annual Business Meeting of the Society two friends, as Visitors, who shall, however, not be entitled to take any part in the business of the Meeting.

EDINBURGH,
5th February 1908.

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Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1908.

THE ANNUAL MEETING.

The Fifty-fifth Annual General Meeting of the Royal Scottish Arboricultural Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Wednesday, 5th February 1908, at 3 P.M. Sir KENNETH J. MACKENZIE, Bart. of Gairloch, President, presided over a large attendance of Members.

APOLOGIES.

Apologies for absence were intimated from Sir John Stirling-Maxwell, Bart., Vice-President; Colonel Bailey, Hon. Editor; Mr Sydney J. Gammell of Drumtochty, Vice-President of the Aberdeen Branch; Messrs Robert Allan, James Whitton, John Boyd, J. D. Crozier, Members of Council; and Messrs John D. Sutherland, Oban; J. H. Milne-Home, Irvine House, Canonbie; and Alex. Milne, Nurseryman, Edinburgh.

MINUTES.

The CHAIRMAN mentioned that the Minutes of the last Meeting had already been printed and issued to the Members, along with

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the *Transactions*, and on his suggestion they were held as read and approved of.

Laws.

The Chairman said that a proof of the revised Laws had been before the Members for a year. One or two suggestions had been submitted to the Council regarding them, and had been carefully considered. He now moved, on behalf of the Council, that the revised Laws and By-Laws, as sent in proof to all Members of the Society, be approved and adopted in place of the existing Laws and By-Laws, subject to the following alterations, viz.:—That Clause 7 on page 2, which refers to the acquisition of lands and buildings, should be deleted; that the words "including lands and buildings," in Law XI. page 4, be deleted; and that the word "Trust" be inserted in Law XI. page 4, between "such" and "security," so as to put it beyond doubt that the Society must invest its funds in Trust securities only. Mr M'Hattie seconded the motion, which was unanimously adopted.

Report by the Council.

The Secretary then read the following Report by the Council, viz.:—

Membership.

The Membership of the Society has been well maintained during the year, although considerable loss has been sustained, as usual, through deaths, resignations, and lapses. Four Honorary Members have died, viz.:—Sir Dietrich Brandis, Professor Gayer, Sir Charles B. Logan, and General Michael. Amongst other Members who have died during the year the following may be mentioned:—Sir George Macpherson Grant, Bart.; Lieutenant-Colonel Innes of Learney; Captain Brodie of Lethen; Mr William Leigh, of Woodchester Park; Mr William Allaway, Edinburgh; Mr Walter Haddon, Hawick; Mr John Horne, Mauritius; Mr W. P. Edwards, S.S.C.; Mr Archibald Lockhart, Huntly; and Dr Buchan, Edinburgh. The total Membership reported at last Annual Meeting was 1159. Since then 132 new Members have been elected (including two Honorary Members), but 79 names have been deleted

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from the list owing to the causes mentioned above. The Membership at this time is therefore 1212, made up as follows:—

Honorary Members, . . .	19
Honorary Associate Members, .	7
Life Members, ...	323
Ordinary Members, . . .	863
	1212

Syllabus and Prizes.

The Syllabus of Competitions for 1907 was issued along with the *Transactions* at the end of December 1906. It included 20 subjects for Essays, for several of which valuable money prizes were offered. Five Essays were received, all of which obtained awards; but it is to be regretted that none of the valuable prizes were competed for. The prizes awarded were—One No. 1 Silver Medal, two No. 2 Silver Medals, and two Bronze Medals. The Syllabus for 1908 was issued along with the *Transactions* at the end of the year.

Donors.

The thanks of the Society are again due to Mr W. H. Massie, Mr David W. Thomson, and Mr John Methven, for renewing their offers of prizes for subjects in the present year's Syllabus, and to the Directors of the Highland and Agricultural Society for renewing their grant of £20 for home-grown timber to be exhibited in the Forestry Exhibition in their Showyard at Aberdeen.

Editorial Work.

A misunderstanding having arisen between the Honorary Editor and the Assistant Editor regarding the method of carrying on the Editorial work, a special Committee of the Council was appointed to inquire into and report on the matter. The Committee found it necessary to define the duties of the Honorary Editor, the Assistant Editor, and the Secretary, with regard to the *Transactions*, and copies of their allocation of the work was sent to the officials mentioned. Unfortunately the Assistant Editor found himself unable to carry on the duties under the conditions laid down by the Committee, and his resignation was accepted with much regret. A temporary arrangement was then made, under which the allowance, at the rate of £25 per annum, previously paid to the Assistant

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Editor, was continued to the Honorary Editor, to enable him to receive assistance, and as this arrangement has worked satisfactorily, the Council propose to maintain it.

An annual grant of £10 has also been placed at the disposal of the Honorary Editor, to be used, when necessary, to obtain the "Continental Notes," formerly contributed gratuitously by Dr Nisbet, who, the Council regret to report, has found it impossible to continue this work for the Society.

Local Branches.

The Aberdeen Branch, recently established, continues to carry on its work in an efficient manner, and it will this year have to undertake most of the responsibility connected with the Society's Exhibition at Aberdeen. A Report from the Branch will be submitted in the course of these proceedings.

As was reported at the General Meeting in July, a Branch of the Society was established at Inverness on 4th May last. This Branch is to be known as the Northern Branch, and its laws have been submitted to and approved by the Council. A Report from this Branch will also be submitted later, from which it will be seen that it is in a very active and flourishing condition.

The question of the representation of these Branches upon the Council of the Society was raised at last Annual Meeting, and the Council, after carefully considering the matter, decided that at the close of each year the Branches should be asked to send in names to the Secretary, which, with the names submitted by individual members of the Council, would be considered by the Council in making their recommendations of eligible Members to fill the vacancies for the ensuing year. This procedure was followed on the present occasion, and it is hoped that it will work satisfactorily.

Forestry Exhibition.

The Annual Forestry Exhibition was last year held in Edinburgh, and was visited by His Royal Highness the Prince of Wales, and by a large number of the general public. The Judges' Report, as usual, was printed in full in the proceedings of the General Meeting held at Edinburgh in the course of the Show week, and a Report of the Exhibition will be found on page 90 of Vol. XXI. of the *Transactions*. All the money prizes offered by the Highland Society were awarded, with the exception of the third prize of £1 in Competition No. II. In addition to the money prizes, the following Medals were awarded, viz.:—one Gold Medal, seven No. 1 Silver Medals, eight No. 2 Silver

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Medals, and four Bronze Medals. A few of those to whom Medals were awarded exercised their option of claiming their converted value in money. The Exhibition is to be held in Aberdeen this year. The revised Schedules have been issued to the Members, and from these it will be seen that Competitions I., II., III., and IV. for Timber Exhibits have been divided into Open and Local Sections. The Local Section is confined to timber grown within the area of the Show, viz.,—Aberdeen, Banff, and Kincardine. The prizes, amounting to £20, in the Open Section are provided by the Highland and Agricultural Society; and those, amounting to £9, in the Local Section are offered by this Society. The Members of the Committee are—Mr GAMMELL of Drumtochty; Mr JOHN D. CROZIER, Durris; Mr JOHN CLARK, Haddo House; Mr CHARLES FRANCE, Aberdeen; Mr G. U. MACDONALD, Peebles; and Mr ADAM SPIERS, Edinburgh.

General Meeting.

The General Meeting was held in the Highland and Agricultural Society's Showyard at Prestonfield, Edinburgh, in the course of the Exhibition week, when the Judges' Reports on the Exhibition and Essays were submitted, and other business transacted. An address on "Heredity and Forestry" by Dr Somerville, was, in his unavoidable absence, read by Dr Borthwick. A full report of the proceedings was, as usual, printed and bound up with the last part of the *Transactions*.

Annual Excursion.

The Annual Excursion, which was well attended, was held in the Strathspey district on the 6th of August and three succeeding days, Elgin being the headquarters. The estates visited were the Seafield Estates (Castle Grant and Abernethy districts), Ballindalloch, Aberlour, Orton, and Gordon Castle. Mr Wiseman's Nurseries at Elgin were also visited. A report of the proceedings was published in the last part of the *Transactions*. A photograph of the party was taken at Gordon Castle, of which a copy was presented to each Member who contributed to the common purse. On the return of the party, the thanks of the Society were formally conveyed to the proprietors for the privilege of visiting their estates, and for their generous hospitality to the Members. The intimation of the death of Sir George Macpherson Grant was heard with great regret by all the Members of the Society, but especially by those who had taken part in the Excursion, and who had been so kindly received and entertained by him at Ballindalloch. A message

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of condolence was sent to his family, and a wreath was forwarded to be laid on his grave.

At the General Meeting in July, it was decided that next Excursion should be confined to the Edinburgh district, in view of the fact that the Scottish National Exhibition is to be held in Edinburgh this year. No arrangements have yet been made as to the estates to be visited, but an invitation has been received from Messrs Dickson & Co. to visit their nurseries at Craigmillar. A discussion took place with regard to the date usually fixed for the Excursion, and it was decided that Members should send their suggestions on the subject to the Secretary.

Scottish National Exhibition.

The Council has arranged that the Society shall have an exhibit of Forestry in this Exhibition, which is to be held in Saughton Park, Edinburgh, from May to October. A suitable space in the North Garden has been allotted to the Society free of charge. On part of it a small pavilion will be erected to receive such of the exhibits as require to be under cover, and the remainder of the space will be available for outside exhibits. An invitation was sent to the Members on 22nd June last asking offers of exhibits, and this invitation has been repeated in the circular calling this Meeting. A number of offers have already been received by the Committee, and they hope that Members will now heartily respond to their appeal. Entry forms may be obtained at this meeting, or on application to the Secretary.

The Society's Flag.

In connection with the Annual Exhibition, the Council considered it advisable that a flag should be secured for the Society. Designs were submitted by Mr William Calder, Leith, and a red flag with the Society's emblem in the centre was ultimately fixed on, and was used at the Edinburgh Exhibition for the first time. It was also used at the Headquarters in Elgin during the Society's Excursion.

Library and Museum.

A list of additions to the Library since last Annual Meeting is appended to this Report. (See Appendix H.)

An interesting addition to the Museum has been made by Mr James N. B. M'Donald, formerly of Powerscourt and now

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of Point Grey, Vancouver, B.C., consisting of a Siwash or Indian hammer or mallet, axe and chisel and spear point, found near Fraser River, Vancouver.

The question of a room for the accommodation of the Society's books, papers, etc., is still under the consideration of the Council, and it is hoped that before another year a satisfactory arrangement will have been made with regard to this matter.

Register of Foresters.

Members are reminded that this Register is now in operation. It is hoped that greater use may be made of the Register by both proprietors and estate men.

The Laws.

The revised Laws, which were sent in proof to Members previous to last Annual Meeting, have been passed by the Society at this Meeting, and are therefore in operation. It is proposed that a copy of these Laws shall be included in next part of the *Transactions*, and be thus available to all the Members.

Resolution.

The Resolution which was passed at last Annual Meeting, with the reasons adduced in support of it, were duly forwarded by the President to the Secretary for Scotland, and acknowledged by him.

Since then the Government has purchased the estate of Inverliever in Argyllshire, and on receiving official information regarding this purchase, the Council forwarded the Resolution mentioned below to the Prime Minister, the Secretary for Scotland, the Chancellor of the Exchequer, the President of the Board of Agriculture, and Mr Stafford Howard, Commissioner of Woods, etc., who all sent the usual formal acknowledgments. The Council now begs to submit, for the approval of the Society, the following Resolution passed at their Meeting held to-day, namely:—"The Royal Scottish Arboricultural Society, in Annual Meeting assembled, hereby homologates the Resolution passed by the Council of the Society on 15th October 1907, as follows: 'The Council, while feeling gratified that a beginning in State Afforestation in the Highlands had been made, a policy which they think should be rapidly developed, would reassert their views as to the

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pressing need for a Demonstration Forest, and would earnestly repeat their request that the Government should purchase a suitable area, with sufficient timber on it, as indicated in the Departmental Committee's Report, and that this, together with Example Plots in connection with the various centres of forestry instruction, and other educational facilities, should be provided without further delay.' The Society further recommends that a Board of Forestry for Scotland, or a Commission under the Board of Agriculture, should be established to foster and promote State and private afforestation in the country, with special power to survey and indicate all land suitable for afforestation, and should be provided with sufficent funds to carry on its work efficiently."

Luncheon.

As in recent years the attendance at the Annual Dinner has considerably decreased, the Council this year decided to arrange for a luncheon instead of a dinner. The attendance at the luncheon to-day would seem to indicate that the change has been a welcome one, and the Council propose, with the approval of the Members, that it should be continued.

Accounts.

The Abstract of Accounts was submitted by Mr Methven, Convener of the Finance Committee, who read the Auditor's docquet, and mentioned that the finances of the Society were in a very healthy condition. (See Appendix A.)

Dunn Memorial Fund.

Mr Methven also submitted the Account of the Dunn Memorial Fund, which showed a balance of £15, 15s. 6d. in hand. (See Appendix B.)

Excursion Fund Account.

The Secretary submitted the Account in connection with this Fund for the past year, which, according to the Auditor's docquet, showed a balance in hand of £32, 6s. 4d. (See Appendix C.)

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Reports from Local Branches.

The Reports received from the Aberdeen and Northern Branches were afterwards read by the Secretary. (See Appendices D, E, and F.)

Chairman's Remarks.

The Chairman said he had great pleasure indeed in moving the adoption of the various Reports, from which it was evident that the Society was in a prosperous condition. They had increased their Membership by 54, and their income had also been increased by about £50. He thought that was a very satisfactory state of affairs; he hoped that this progress would be maintained, and that the Society would become a still more powerful body than it was at present. The Reports were adopted.

The President further moved that the Resolution embodied in the Council's Report should be sent in the usual way to the Ministers mentioned above, and this was unanimously agreed to.

Office-Bearers.

On the motion of Mr Munro Ferguson, Sir Kenneth Mackenzie was re-elected President for another year.

Sir John Stirling-Maxwell was re-elected a Vice-President; and Mr John Methven, Nurseryman, Edinburgh, and Mr James Johnstone, Alloway Cottage, Ayr, were elected new Vice-Presidents.

Dr Borthwick, Mr Leven, and Mr Annand were re-elected to the Council, and the new Councillors elected were:—Lord Mansfield, Mr Sydney J. Gammell of Drumtochty, Mr Broom, Wood Merchant, Bathgate, and Mr J. W. M'Hattie. The following were re-elected:—Mr Munro Ferguson, Honorary Secretary; Mr R. Galloway, S.S.C., Secretary and Treasurer; Colonel Bailey, Honorary Editor; and Mr John T. Watson, Auditor. Mr Andrew Watt, M.A., F.R.S.E., Secretary of the Scottish Meteorological Society, was elected Honorary Consulting Meteorologist in succession to Mr R. C. Mossman, resigned; and the other Honorary Consulting Officials and

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the Local Secretaries were re-elected. (For detailed list of Office-Bearers and others see Appendix G.)

Annual Excursion.

Mr Charles Buchanan, Convener of the Excursion Committee, said that as the Headquarters this year would be Edinburgh, there were a number of places in the neighbourhood which might be visited, such as Dalkeith, Newbattle, Arniston, Rosebery, Hopetoun, Dundas, Hawthornden, Roslin, and Penicuik, while Whittinghame and Gosford were also within easy reach. A day might also be spent in the public parks and nurseries, and another in the Scottish National Exhibition. The Chairman said he had no doubt that the meeting would be very pleased to leave the matter in the capable hands of Mr Buchanan and his Committee.

Forestry Exhibition in Aberdeen.

Mr Adam Spiers reminded the Meeting that Schedules in connection with the Society's usual Exhibition in the Highland and Agricultural Society's Show, which was this year to be held in Aberdeen, had been issued to the Members along with the notice calling the Meeting. He had no doubt the Aberdeen Branch would take the matter up very heartily, and, considering the additional inducements offered this year by providing prizes confined to local competitors, he believed the Exhibition would prove as attractive as any that had yet been held.

Scottish National Exhibition.

Mr Massie, Convener of the Committee in charge of the Society's arrangements for an exhibit of Forestry in this Exhibition, said that very good progress was being made with the arrangements. They had an enthusiastic Committee who were doing excellent work, and he hoped the Members would also give an enthusiastic response to the appeal which had been made for offers of exhibits. They were, however, short of funds, but he was sure he had only to mention that

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they had opened a Guarantee Fund, to which they might all be subscribers, to ensure a speedy end to their financial troubles.

This concluded the business part of the proceedings, and on the motion of Mr JOHN METHVEN, a hearty vote of thanks was accorded to Sir Kenneth Mackenzie for presiding.

MR BALFOUR'S ADDRESS.

An address was then delivered by Mr F. R. S. BALFOUR, Dawyck, Peeblesshire, on the "Trees of Western America," with lantern illustrations, in the course of which he described and showed views of a large number of trees seen by him during an expedition to Alberta and the States of Washington and Oregon last year.

At the close of the lecture, the PRESIDENT said that they had listened to an exceedingly interesting and valuable address, which he had no doubt would be reported in the *Transactions*. On his motion a hearty vote of thanks was accorded Mr Balfour.

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APPENDIX A.—Abstract of Accounts for Year ending 31st December 1907.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1906,			£1518 10 0
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 113½,	£567 10 0		
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 119,	595 0 0		
£400 North British Railway Company 3 per cent. Debenture Stock, at 89,	356 0 0		
2. Life Members' Subscriptions in 1907,			98 14 0
New Members,	£84 0 0		
Ordinary Members by commutation,	14 14 0		
			£1617 4 0

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,			£101 18 9
Unexhausted: £716 7 1, 76 4 3	1/10 of Full Life Subscriptions,	£84 3 11	
	1/10 of Commuted Subscriptions,	17 14 10	
2. Decrease in value of Railway Stocks at 31st December 1907,			80 10 0
3. Funds at 31st December 1907,			1434 15 3
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 107½,	£537 10 0		
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 112,	560 0 0		
£400 North British Railway Company 3 per cent. Debenture Stock, at 85½,	340 10 0		
	£1438 0 0		
Less Balance at debit of Capital,	3 4 9		
	£1434 15 3		
			£1617 4 0

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1906,			£214 3 1
2. Ordinary Members' Subscriptions,			359 12 0
Arrears at 31st December 1906,	£38 6 0		
Add Arrears written off but since recovered,	1 8 0		
		£39 14 0	
Subscriptions for 1907,	£372 7 0		
Less Received in 1905 and 1906,	8 5 6		
		364 1 6	
Subscriptions for 1908 received in 1907,		5 12 0	
		£409 7 6	
Deduct—			
Cancelled or written off as irrecoverable at 31st December 1907,	£27 9 0		
Arrears at 31st December 1907,	22 6 6		
		49 15 6	
			£359 12 0

DISCHARGE.

1. Printing, Stationery, etc.,			£200 19 8
Vol. XX. Part I. of *Transactions* (Blocks £2, 3s. 6d.),	£91 12 9		
Authors' Reprints,	2 3 0		
		£93 15 9	
Vol. XX. Part II. of *Transactions* (Blocks £1, 5s. 6d.),	£87 19 3		
Authors' Reprints,	2 1 6		
		90 0 9	
		£183 16 6	
General Printing and Stationery,		49 6 3	
Forestry Periodicals, Binding, etc.,		2 8 0	
		£235 10 9	
Less Receipts for Advertisements in *Transactions*,		34 11 1	
		£200 19 8	
2. Prizes (Money £32, Medals £15, 9s. 9d., and Books £2),		£49 9 9	
Less Donation from the Highland and Agricultural Society, for Prizes awarded for Horses exhibited at Peebles,		19 9 9	

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Capital,		101 18 9
4. Dividends and Interest,		57 4 2
5. *Transactions*, etc., sold,		18 12 4
6. Income Tax Recovered,		2 6 0
		£753 16 4

Society's Show at Edinburgh—			
Printing,	£9 1 0		
Advertising,	0 16 0		
Extra Tabling, Racks, Carriages, Etc.,	12 19 0		
Outlays at Peebles Show 1906,	1 17 3		
			24 13 3
4. Scottish National Exhibition 1908—			
Expenses at Dublin inspecting Pavilion offered for hire,			5 0 0
5. Contribution to Funds of Aberdeen and Northern Branches, £5 each,			10 0 0
6. Expenses of Management,			216 11 3
Rent,	£3 14 0		
Auditor,	3 3 0		
Assistant Editor, Year and half at £25,	37 10 0		
Honorary Editor, for French Notes for Part I. Vol. XXI.,	5 0 0		
Secretary and Treasurer,	100 0 0		
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	3 8 0		
Outlays in connection with Annual Dinner,	5 1 6		
Flag,	2 12 6		
Postages and Miscellaneous Outlays, viz.:			
Postages of Parts I. and II. of Vol. XX. of *Transactions*, £25 15 3			
General Postages, Commissions on Cheques, and Petty Outlays, 30 7 0			
	56 2 3		
	£216 11 3		
7. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*,			266 2 5
			£753 16 4

Note.—Balance of Revenue as above, £266 2 5
Less Balance at debit of Capital as above, 3 4 9
£262 17 8

Consisting of—

Sum in Deposit Receipt of National Bank of Scotland, Limited,	£250 0 0	
Sum at credit of Account Current of National Bank of Scotland, Limited,	12 8 7	
Sum in hands of Treasurer,	0 9 1	
		£262 17 8

EDINBURGH, 20*th January* 1908.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1907, of which the above is an Abstract, and have found them correct. The Securities, representing the Society's Funds as above, have also been exhibited to me.

JOHN T. WATSON, *Auditor.*

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APPENDIX B.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, 1907.

RECEIPTS.

Balance in Bank at close of last Account, . .	£12	18	6
Dividend on £100 3 per cent. Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas 1907, £3, *less* Tax 3s.,	2	17	0
	£15	15	6

PAYMENTS.

Nil.

Balance carried forward, being sum in National Bank of Scotland on Account Current, ...	£15	15	6

Note.—The Capital belonging to the Fund consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

EDINBURGH, *20th January* 1908.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

JOHN T. WATSON,
Auditor.

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APPENDIX C.

Excursion Account.

Abstract of Accounts—January 1907.

Balance brought from last Account, . . .		£30	9 5
Received for Photographs—Lambton Park, 1906,		4	16 0
		£35	5 5
Deduct—			
Paid to Mr A. D. Richardson sum collected for Photographs, .	£4 16 0		
Auditor's Fee (John T. Watson) 1906,	2 2 0		
		6	18 0
		£28	7 5

Excursion to Strathspey.

RECEIPTS.

Contributions to Common Purse, £206, 1s., *less* repayments of 5 deposits of 10s.,	£203	11 0

PAYMENTS.

Grand Hotel, etc., Elgin, and driving to Orton, . .	£107	2	3	
Driving—				
Ballindalloch and Aberlour, ...	10	0	0	
Grantown and Abernethy (two days), . .	24	10	0	
Railways: Local Journeys—				
Highland, ...	13	10	0	
Great North of Scotland,	14	17	2	
Photographs—				
Gordon Castle Group, .	14	2	0	
Printing, ...	4	3	9	
Gratuities and Sundry Outlays, ...	11	6	11	
		199	12 1	
				3 18 11
Balance carried forward to next Account, being sum in National Bank of Scotland, Ltd., on Account Current, . . .				£32 6 4

Edinburgh, *24th January* 1908.—Examined with Vouchers and Memorandum Book and found correct. Bank Certificate of above balance of £32, 6s. 4d. also exhibited.

John T. Watson,
Auditor.

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APPENDIX D.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

Report by the Committee of the Proceedings of the Branch to the Second Annual General Meeting, held at Aberdeen on Saturday, 7th December 1907.

The Membership of the Branch has been slightly increased during the past year, but the Committee wishes to impress on all Members of the parent Society resident in the district, their duty to join the Local Branch of the Society.

One Excursion was held during the summer, on 29th June, to Durris, a report of which will be submitted by Mr Rule. It was considered advisable to hold only this one Excursion, in respect that the Annual Excursion of the Society was this year held partly in the area of the Branch.

The Committee offered prizes to assistant foresters for Essays on forestry subjects, but no advantage has been taken of the offer.

In view of the forthcoming Highland Society's Show at Aberdeen in 1908, the Committee has had under consideration how it could best assist the Forestry Department, and encourage Members to put forward exhibits. With this object the Committee has asked the Council of the parent Society to allocate prizes for exhibits, such as timber, to be confined to specimens from the area of the Show.

The Branch was invited to nominate Members to serve on the Council of the parent Society, and the Committee unanimously recommended Mr Sydney J. Gammell of Drumtochty.

The Committee has decided by ballot that the order of retiral from the Committee should be as follows:—

Those who retire this year—Messrs Crozier, Braid, France, and Michie. These gentlemen are eligible for re-election.

Those who retire next year—Messrs Rule, Bell, Robson, and Duthie.

Those who retire the following year—Messrs Clark, Greig, Hart, and Allan.

The newly-elected Members to be placed at the foot of the list.

Since the last Annual Meeting some of the Members have

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been removed by death, and it is with feelings of deep regret that the Committee have to record the death of Lieut.-Colonel F. N. Innes of Learney, one of the Vice-Presidents, whose great interest in the affairs of the Branch and Forestry in general will not soon be forgotten. Mr Archibald Lockhart, Huntly, has also passed away, and those Members who took part in the Excursion to Huntly last year, must have many happy recollections of his kindness when visiting his firm's saw-mills. Although not so well known to some of the Members, but still a prominent member of his profession in Aberdeen, the name of Mr George Philip, superintendent of Stewart Park, must be added to the death roll of the Branch; and only this week the newspapers have recorded the death of Sir George Macpherson Grant, Bart. of Ballindalloch.

The financial statement of the Branch shows an income of £12, 10s. 9d., including the grant of £5 from the parent Society, and an expenditure of £3, 12s. 7d., leaving a credit balance of £7, 14s. 2d. on the General Account, and a balance of 4d. at the credit of the Excursion to Durris, which, with a balance of £1, 4s. at the credit of the Excursion Fund, makes the total credit balance of the Branch £8, 18s. 6d., and this sum is placed with the Aberdeen Savings Bank.

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APPENDIX E.

Royal Scottish Arboricultural Society—Aberdeen Branch.

STATEMENT OF ACCOUNTS, 1907.

INCOME.

Balance at credit of General Account,	£3 0 2	
Balance at credit of Excursion Fund,	1 4 0	
Balance at credit at close of last Account,	£4 4 2	£4 4 2
By Cash Subscriptions from 49 Members at 1s. each,	£2 9 0	
,, Cash Donation from President,	0 10 0	
,, Cash Arrears of Subscriptions, 1906,	0 4 0	
,, Cash Subscriptions received for 1908,	0 2 0	
		3 5 0
,, Cash Grant from parent Society,		5 0 0
,, Cash Savings Bank Interest per Bank Book,		0 1 7
		£12 10 9

EXPENDITURE.

To Cash paid Wm. Walker & Son,	£0 13 0
,, Cash paid W. O. Webster & Co.,	0 11 9
,, Cash paid Wm. Mutch, Printer,	0 14 9
,, Cash paid postages for the year,	1 12 7
,, Cash paid charge on Mr Galloway's cheque,	0 0 6
,, Balance at credit carried to Abstract,	8 18 2
	£12 10 9

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EXCURSION TO DURRIS ON 29th JUNE 1907.

INCOME.

By Cash from 17 Members for Lunch and Driving at 4s. each,	£3	8	0
,, Cash from 11 Members for Lunch at 2s. each,	1	2	0
,, Cash from 1 Member 3s.,	0	3	0
	£4	13	0

EXPENDITURE.

To Cash paid T. N. Clapperton for 39 Luncheons at 11d. each,	£1	15	9
,, Cash paid Craighead & Co., Grocers,	0	6	2
,, Cash paid Aberdeen Riding Academy,	2	10	0
,, Cash paid Toll at Park Bridge,	0	0	9
,, Balance at credit carried to Abstract,	0	0	4
	£4	13	0

EXCURSION FUND.

Balance at credit for 1906,	£1	4	0
Balance at credit of Excursion to Durris,	0	0	4
	£1	4	4

ABSTRACT.

Balance at credit of General Account,	£8	18	2
Balance at credit of Durris Excursion,	0	0	4
Balance at credit of Branch, (as per Aberdeen Savings Bank Pass Book, No. F 648.)	£8	18	6
Being Balance at credit of General Account,	£7	14	2
,, Balance at credit of Excursion Fund,	1	4	4
	£8	18	6

COWIE MAINS, STONEHAVEN, *5th December* 1907. - I have examined the foregoing Statement of Accounts for year 1907 of the Aberdeen Branch of the Royal Scottish Arboricultural Society, and have found the same correctly stated and fully vouched. The balance at the credit of the Society at the end of the year, amounting to Eight pounds eighteen shillings and sixpence, is deposited in the Aberdeen Savings Bank.

JOHN HART, *Auditor*.

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APPENDIX F.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (NORTHERN BRANCH).

Report by the Committee of the Proceedings of the Branch to 31st December 1907.

The Branch was inaugurated on the 4th day of May 1907, at a meeting of the Society held in the Station Hotel, Inverness, presided over by the President, Sir Kenneth J. Mackenzie, Bart. of Gairloch.

Since its inauguration the Branch has held three meetings, consisting of an Excursion to Beaufort on 13th July, an Ordinary Meeting on 28th September, when the President delivered an address, after which the Members visited the Nurseries of Messrs Howden & Co., and an Excursion to Novar on 19th October.

Both Excursions were well attended by the Members, and Reports upon them are appended to this minute for the information of the Council of the Society.

The Branch was fortunate enough to receive the permission of the Magistrates and Town Council of Inverness for the use of a room in the Town Hall Building for its meetings, and the thanks of the Branch are due to the Corporation of Inverness for this privilege.

In the District comprising the Branch, consisting of the Counties of Inverness, Elgin, Nairn, Ross and Cromarty, Sutherland and Caithness, there are 76 Members of the Society, and of these 44 have affiliated themselves to the Branch, and several new Members have been elected for the Society, the total Membership of the Branch at the date of the Report being 68. The Committee hopes that all Members of the parent body resident in the district will become Members before the next Annual Meeting.

The income of the Branch to date is £8, 8s., including a grant of £5 from the parent Society, but as by the Constitution and By-Laws of the Branch the first Election of Office-Bearers

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under the Rules will not take place till December 1908, a full year's working cannot at the present moment be reported.

With reference to the costs of the Excursions, the Committee desire to record their appreciation of the kindness of the Right Hon. Lord Lovat and of Mr Munro Ferguson of Novar, who so kindly entertained the Members at Beaufort and Novar on their visit to the woods on these estates.

On behalf of the Committee of the Northern Branch of the Society.

ALEX. FRASER,
Secretary and Treasurer.

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APPENDIX G.

Office-Bearers for 1908:—

PRESIDENT.

Sir KENNETH J. MACKENZIE, Bart. of Gairloch, 10 Moray Place, Edinburgh.

VICE-PRESIDENTS.

D. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Midlothian.
Sir THOMAS GIBSON CARMICHAEL, Bart. of Castle Craig, Malleny House, Balerno.
W. STEUART FOTHRINGHAM of Murthly, Perthshire.
Sir JOHN STIRLING-MAXWELL, Bart. of Pollok, Pollokshaws.
JOHN METHVEN, Nurseryman, 15 Princes Street, Edinburgh.
JAMES JOHNSTONE, F.S.I., Factor, Alloway Cottage, Ayr.

COUNCIL.

JOHN BOYD, Forester, Inverliever, Ford, Lochgilphead.
A. T. GILLANDERS, F.E.S., Forester, Alnwick Castle, Northumberland.
W. H. MASSIE, Nurseryman, 1 Waterloo Place, Edinburgh.
CHARLES BUCHANAN, Overseer, Penicuik Estate, Penicuik.
JOHN D. CROZIER, Forester, Durris Estate, Drumoak, Aberdeenshire.
W. A. RAE, Factor, Murthly, Perthshire.
JAMES WHITTON, Superintendent of City Parks, City Chambers, Glasgow.
ROBERT ALLAN, Factor, Polkemmet, Whitburn.
JAMES COOK, Land Steward, Arniston, Gorebridge.
ROBERT FORBES, Overseer, Kennet Estate Office, Alloa.
SIMON MACBEAN, Overseer, Erskine, Glasgow.
G. U. MACDONALD, Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
GEORGE MACKINNON, Overseer, Melville, Lasswade.
ADAM SPIERS, Timber Merchant, Warriston Saw-Mills, Edinburgh.
Dr A. W. BORTHWICK, Royal Botanic Garden, Edinburgh.
GEORGE LEVEN, Forester, Auchincruive, St Quivox, Ayr.
JOHN BROOM, Wood Merchant, Bathgate.
SYDNEY J. GAMMELL of Drumtochty, Countesswells House, Bieldside, Aberdeen.
JOHN W. M'HATTIE, Superintendent of City Parks, City Chambers, Edinburgh.
EARL OF MANSFIELD, Scone Palace, Perth.
JOHN ANNAND, Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.

HON. SECRETARY.

R. C. MUNRO FERGUSON, M.P., of Raith and Novar, Raith House, Kirkcaldy.

SECRETARY AND TREASURER.

ROBERT GALLOWAY, S.S.C., 19 Castle Street, Edinburgh.

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HON. EDITOR.

Colonel F. BAILEY, R.E., University Lecturer on Forestry, 7 Drummond Place, Edinburgh.

AUDITOR.

JOHN T. WATSON, 16 St Andrew Square, Edinburgh.

TRUSTEES.

R. C. MUNRO FERGUSON, M.P., W. STEUART FOTHRINGHAM of Murthly, and Sir JOHN STIRLING-MAXWELL, Bart. of Pollok.

HONORARY CONSULTING OFFICIALS.

Consulting Botanist.—ISAAC BAYLEY BALFOUR, LL.D., M.D., Sc.D., Professor of Botany, University of Edinburgh, and Regius Keeper, Royal Botanic Garden, Edinburgh.

Consulting Chemist.—ALEXANDER LAUDER, D.Sc., F.C.S., 13 George Square, Edinburgh.

Consulting Cryptogamist.—A. W. BORTHWICK, D.Sc., Royal Botanic Garden, Edinburgh.

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., 13 Archibald Place, Edinburgh.

Consulting Geologist.—R. CAMPBELL, M.A., B.Sc., Geological Laboratory, University of Edinburgh.

Consulting Meteorologist.—ANDREW WATT, M.A., F.R.S.E., Secretary, Scottish Meteorological Society, 122 George Street, Edinburgh.

JUDGES AND TRANSACTIONS COMMITTEE.

Colonel F. BAILEY, Lecturer on Forestry, University of Edinburgh (*Convener*).
D. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Midlothian.
JOHN ANNAND, Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.
A. T. GILLANDERS, F.E.S., Forester, Alnwick Castle, Northumberland.
Dr A. W. BORTHWICK, Royal Botanic Garden, Edinburgh; and
The SECRETARY.

PHOTOGRAPHIC ARTIST.

A. D. RICHARDSON, 6 Dalkeith Street, Joppa.

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LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyle,	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	WM. MILNE, Foulden Newton, Berwick-on-Tweed.
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
	JAMES KAY, Forester, Bute Estate, Rothesay.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumbarton,	ROBERT BROWN, Forester, Boiden, Luss.
Dumfries,	D. CRABBE, Forester, Byreburnfoot, Canonbie.
	JOHN HAYES, Dormont Grange, Lockerbie.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	JAMES CRABBE, Forester, Glamis.
	JAMES ROBERTSON, Forester, Panmure, Carnoustie.
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine,	JOHN HART, Estates Office, Cowie, Stonehaven.
Kinross,	JAMES TERRIS, Factor, Dullomuir, Blairadam.
Lanark,	JOHN DAVIDSON, Forester, Dalzell, Motherwell.
	JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.
Moray,	JOHN BRYDON, Forester, Rothes, Elgin.
	D. SCOTT, Forester, Darnaway Castle, Forres.
Perth,	W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.
	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Renfrew,	S. MACBEAN, Overseer, Erskine, Glasgow.
Ross,	JOHN J. R. MEIKLEJOHN, Factor, Novar, Evanton.
	Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.
Roxburgh,	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland,	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown,	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

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England.

Counties.	
Beds, . .	FRANCIS MITCHELL, Forester, Woburn.
Berks, . .	W. STORIE, Whitway House, Newbury.
Cheshire, .	WM. A. FORSTER, Belgrave Lodge, Pulford, Wrexham.
Devon, . .	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham, .	JOHN F. ANNAND, Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.
Hants, . .	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts, . .	JAMES BARTON, Forester, Hatfield.
	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent, . .	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire, .	D. C. HAMILTON, Forester, Knowsley, Prescot.
Leicester, .	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln, .	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Middlesex, .	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens, Surrey.
	Professor BOULGER, 11 Onslow Road, Richmond Hill, London, S.W.
Notts, . .	WM. ELDER, Thoresby, Allerton, Newark.
	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Salop, . .	FRANK HULL, Forester, Lillieshall, Newport.
Suffolk, . .	ANDREW BOA, Agent, Skates Hill, Glemsford.
	GEORGE HANNAH, The Folly, Ampton Park, Bury St Edmunds.
Surrey, . .	ANDREW PEEBLES, Estate Office, Albury, Guildford.
Warwick, .	A. D. CHRISTIE, 16 Oak Tree Lane, Selly Oak, Birmingham.
York, . .	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin, . .	A. C. FORBES, Department of Forestry, Board of Agriculture.
	JAMES WILSON, B.Sc., Royal College of Science, Dublin.
Galway, . .	ARCH. E. MOERAN, Palmerston House, Portumna.
	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
King's County,	WM. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary, .	DAVID G. CROSS, Forester, Kylisk, Nenagh.

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APPENDIX H.

Presentations to the Society's Library since the publication of last List in Volume XX. Part 2.

Books.

1. *Trees and their Life-History.* By Percy Groom, D.Sc.
2. *Wald und Forstwirtschaft.* By Dr Adam Schwappach.
3. Kew Gardens. Bulletin 1907.
4. *Country Gentlemen's Estate Book*, 1907.
5. *The New Zealand Official Year-Book*, 1906 and 1907.

Societies' Reports, Transactions, Etc.

6. *Annual Report of the Smithsonian Institution*, 1905-1906.
7. *Transactions of the Highland and Agricultural Society*, vol. xix., 1907.
8. *Journal of the Royal Agricultural Society of England*, vol. lxvii.
9. *The 85th Report of Commissioners of Woods and Forests, London*, June 1907.
10. *Report of the Superintendent of Forestry of Canada*, 1906.
11. *Report of the Chief Conservator of Forests, Cape of Good Hope*, September 1906.
12. *Report of State Forest Administration, South Australia*, 1906-07.
13. *Report of the Pennsylvania Department of Forestry for* 1905 and 1906.
14. *Transactions of the Royal English Arboricultural Society*, vol. vii., part 1, 1907.
15. *Report of the Survey Department, New Zealand*, 1906-07.
16. *Report of the Department of Lands, New Zealand*, 1906-07.
17. *Reports of Experimental Farms for* 1906, *Canada.*
18. *Transactions and Proceedings of the Perthshire Society of Natural Science*, vol. iv., parts 3 and 4, 1905-7.
19. *Transactions of the Natural History Society of Glasgow*, vol. vii., parts 2 and 3, 1903-5.
20. *Scientific Transactions of the Royal Dublin Society*, vol. ix.
    Economic Proceedings of the Royal Dublin Society, vol. i., parts 9, 10, and 11.
    Scientific Proceedings of the Royal Dublin Society, vol. xi., Nos. 13-20, 1907.
21. *Transactions of Massachusetts Horticultural Society*, 1906, part 2, and 1907, part 1.
22. *Journal of Royal Horticultural Society*, vol. xxxii.
23. *Calendar for* 1907-08 *of Edinburgh and East of Scotland College of Agriculture.*

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Reprints, Etc.

24. *Working-Plan for Ardross Woods.* By Dr Schlich and R. S. Pearson.
25. *Forest Garden Guide*, Cirenchester, 1906. By F. C. M'Clellan.
26. *A Note on the Duki Fig Tree Borer of Baluchistan.* By E. P. Stebbing, F.L.S.
27. *Bush Fruits.* Bulletin No. 56 Department of Agriculture, Canada.
28. Bulletin No. 9. *Reproduction Series* No. 5 *of the Lloyd Library*, Cincinnati.
29. *Mycological Notes*, Nos. 24, 25, and 26. By C. G. Lloyd.
30. *The Nidulariaceæ or Birds' Nest Fungi.* By C. G. Lloyd.
31. *The Phalloids of Australasia.* By C. G. Lloyd.
32. *Quarterly Journal of the Institute of Commercial Research in the Tropics*, 1907.
33. *The Commercial Possibilities of West Africa.* By Viscount Mountmorres.
34. *Catalogue, Ohio State University*, 1907.
35. *Prospectus of Department of Forestry, Yale University*, 1907-08.
36. *Board of Agriculture Returns and Leaflets.*
37. *Crataegus of Southern Michigan.* By C. S. Sargent, 1907.
38. *Quarterly Journal of Forestry.* London.
39. *Forestry Quarterly.* New York.
40. *Forestry and Irrigation.* Washington.
41. *Journal of the Board of Agriculture of Ireland.*
42. *Journal of the Board of Agriculture.* London.
43. *Skogsvårdsföreningens Tidskrift.* Stockholm.
44. *Tidskrift for Skogbrug.*
45. *Timber Trades Journal.* London.
46. *Journal da Commerce des Bois.* Paris.
47. *Timber News.* London.
48. *Estate Magazine.*
49. *Tropical Life.* Monthly.
50. *Agricultural Economist.* London.
51. *The Indian Forester.* Allahabad.
52. *Revue des Eaux et Forêts.* Paris. (By purchase.)
53. *Allgemeine Forst- und Jagd-Zeitung.* (,,)
54. *Zeitschrift für Forst- und Jagdwesen.* (,,)

Museum.

55. Siwash or Coast Indian Hammer or Mallet.
56. Axe and Chisel.
57. Spear Point.

All found near Frazer River, Point Grey. Presented by Mr J. N. B. M'Donald.

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Royal Scottish Arboricultural Society.

(INSTITUTED 16th FEBRUARY 1854.

LIST OF MEMBERS, &c.

As at 20th June 1908.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PRESIDENT.

Sir KENNETH J. MACKENZIE, Bart. of Gairloch.

FORMER PRESIDENTS.

YEAR.	
1854–56.	JAMES BROWN, { Deputy-Surveyor of the Royal Forest of Dean. Wood Commissioner to the Earl of Seafield.
1857.	The Right Hon. THE EARL OF DUCIE.
1858.	The Right Hon. THE EARL OF STAIR.
1859.	Sir JOHN HALL, Bart. of Dunglass.
1860.	His Grace THE DUKE of ATHOLL.
1861.	JOHN I. CHALMERS of Aldbar.
1862.	The Right Hon. THE EARL OF AIRLIE.
1863.	The Right Hon. T. F. KENNEDY.
1864–71.	ROBERT HUTCHISON of Carlowrie, F.R.S.E.
1872–73.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1874–75.	JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS. L. & E., Professor of Botany in the University of Edinburgh.
1876–78.	The Right Hon. W. P. ADAM of Blairadam, M.P.
1879–81.	The Most Hon. THE MARQUESS OF LOTHIAN, K.T.
1882.	ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh.
1883–85.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1886–87.	The Right Hon. Sir HERBERT EUSTACE MAXWELL, Bart. of Monreith.
1888–89.	The Right Hon. THE MARQUESS OF LINLITHGOW, Hopetoun House, South Queensferry.
1890–93.	ISAAC BAYLEY BALFOUR, M.D., Sc.D., F.R.S., Professor of Botany in the University of Edinburgh.
1894–97.	R. C. MUNRO FERGUSON, M.P.
1898.	Colonel F. BAILEY, R.E.
1899–02.	The Right Hon. THE EARL OF MANSFIELD.
1903–06.	W. STEUART FOTHRINGHAM of Murthly.

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HONORARY MEMBERS.

Date of Election.

1886. AVEBURY, The Right Hon. Baron, D.C.L., High Elms, Down, Kent.
1904. BAILEY, Colonel F., R.E., F.R.S.E., Lecturer on Forestry, Edinburgh University, 7 Drummond Place, Edinburgh. (Also Life Member by Subscription, 1887.)
1907. CASTLETOWN, Right Hon. Lord, of Upper Ossory, K.P., C.M.G., Granston Manor, Abbeyleix, Ireland.
1901. GAMBLE, J. Sykes, C.I.E., F.R.S., M.A., ex-Director of the Indian Forest School, Highfield, East Liss, Hants.
1905. HENRY, Auguste Edmond, Professor of Natural Science, etc., National Forest School, Nancy, France.
1886. HOOKER, Sir Joseph D., O.M., M.D., K.C.S.I., The Camp, Sunningdale, Berks.
1886. JOHORE, The Maharajah of, Johore, Malay Peninsula.
1904. KAY, James, Wood Manager, Bute Estate, Rothesay, Bute. (Elected Ordinary Member in 1867.)
1907. KUMÉ, Kinya, Chief of the Bureau of Forestry, Department of Agriculture and Commerce, Tokio, Japan.
1904. MACKENZIE, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh. (Also Life Member by Subscription, 1872.)
1907. MAYR, Heinrich, Dr. Philos. et D.Œc., Professor of Forestry, Munich.
1903. NILSON, Jägmästare Elis, Föreståndare för Kolleberga skogsskola Ljungbyhed, Sweden.
1889. SARGENT, Professor C. S., Director of the Arnold Arboretum, Harvard College, Brookline, Massachusetts, U.S.A.
1889. SCHLICH, Dr William, Professor of Forestry, Oxford University.
1895. SCHWAPPACH, Dr Adam, Professor of Forestry, Eberswalde, Prussia.
1907. SIMMONDS, Frederick, M.V.O., 16 Abingdon Court, Kensington West.
1904. SOMERVILLE, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Professor of Rural Economy, Oxford. (Also Life Member by Subscription, 1889.)
1886. TAKEI, Morimasa, 58 Mikumicho, Ushima, Tokio, Japan.
1904. THOMSON, John Grant, Wood Manager, Grantown, Strathspey. (Also Life Member by Subscription, 1855.)

HONORARY ASSOCIATE MEMBERS.

Date of Election.

1903. BATTISCOMBE, Edward, Assistant Conservator of Forests, Nigeri *via* Naivasha, East Africa Protectorate.
1901. BRUCE, William, College of Agriculture, 13 George Square, Edinburgh.
1901. CROMBIE, T. Alexander, Forester, Estate Office, Longhirst, Morpeth.
1902. GILBERT, W. Matthews, The *Scotsman* Office, Edinburgh.
1902. SMITH, Fred., Highfield Mount, Brook Street, Macclesfield.
1901. STORY, Fraser, Lecturer on Forestry, University of North Wales, Bangor.
1901. USHER, Thomas, Courthill, Hawick.

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LIFE AND ORDINARY MEMBERS.

* *Indicates Life Member.* *Italics indicates that present Address is unknown.*

LAW V. Members in arrear shall not receive the *Transactions*. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

Date of Election.

1895. ABBOT, Thomas, Forester, Neidpath Castle, Peebles.
*1906. ABERCROMBY, Sir George William, Forglen, Turriff.
1904. *Abernethy, Thomas, Assistant Forester, White Deer Lodge, Welbeck Park, Worksop.*
1902. ACLAND, Sir Charles Thomas Dyke, Bart., M.A., D.L., etc., Killerton, Exeter.
*1900. ADAIR, David Rattray, S.S.C., 19 Castle Street, Edinburgh.
*1907. ADAIR, John Downie, Nurseryman, 75 Shandwick Place, Edinburgh.
*1883. ADAM, Sir Charles Elphinstone, Bart. of Blairadam, 5 New Square, Lincoln's Inn, London, W.C.
*1904. ADAMS, Joseph Wm. Atkin, Resident Agent, Mill Hill, Middlesex.
1906. ADAMSON, John, Assistant Forester, Chatsworth, Pilsley, Bakewell.
*1874. ADDINGTON, The Right Hon. Lord, Addington Manor, Winslow, Bucks.
*1904. AGNEW, Sir Andrew, Bart., Lochnaw Castle, Stranraer.
1903. AILSA, The Marquess of, Culzean Castle, Maybole.
1906. AINSLIE, John, Factor, Stobo, Peeblesshire.
1902. AINSLIE, Thomas, Glenesk, Penicuik.
1902. AITCHISON, William, Assistant Forester, Weirburn Cottage, Grant's House.
1907. AITKEN, James, Assistant Forester, Dean Road, Kilmarnock.
1907. ALDRIDGE, Arthur, Assistant Forester, No. 1 Arch Grove Villa, Long Ashton, near Bristol.
1905. ALEXANDER, Henry, Head Forester, Grimstone Estate, Gilling East, York.
*1883. ALEXANDER, John, 24 Lawn Crescent, Kew Gardens, Surrey.
1903. ALLAN, James, Wood Merchant, Bucksburn.
1905. ALLAN, James, Forester, Lyde Green, Rotherwick, Winchfield, Hants.
*1903. ALLAN, Robert, Factor, Halfway House, Polkemmet, Whitburn.
1905. *Anderson, Duncan, Assistant Forester, Pierremont Nurseries, Darlington.*
1905. *Anderson, George, Forester, Bawdsey Manor, Woodbridge, Suffolk.*
1907. ANDERSON, James, Foreman Forester, Woodlawn, Co. Galway, Ireland.
*1901. ANDERSON, Robert, Bailiff, Phœnix Park, Dublin.
1906. ANDERSON, Robert, Assistant Forester, Fairnington, Roxburgh.
1887. ANNAND, John F., Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.

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Date of Election.

1903. ANSTRUTHER, Sir Ralph, Bart. of Balcaskie, Pittenweem.
1903. ARCHIBALD, John Clark, Head Forester, Eden Hall, Langwathby R.S.O., Cumberland.
*1906. ARDWALL, The Hon. Lord, M.A., LL.D., 14 Moray Place, Edinburgh.
1898. ARMSTRONG, Thos. J. A., Factor, Glenborrodale, Salen, Fort William.
1904. ARNOTT, William, Foreman Forester, Old Scone, Perth.
*1883. ATHOLL, His Grace the Duke of, K.T., Blair Castle, Blair Atholl.
1860. AUSTIN & M'ASLAN, Nurserymen, 89 Mitchell Street, Glasgow.

*1887. BAILEY, Colonel F., R.E., F.R.S.E., Lecturer on Forestry, Edinburgh University, 7 Drummond Place, Edinburgh.
*1906. BAIRD, Henry Robert, D.L., J.P., Durris House, Drumoak, Aberdeen.
*1896. BAIRD, J. G. A., of Adamton, 89 Eaton Square, London, S.W.
1903. BAIRD, William Arthur, of Erskine, Glasgow.
1908. BAKER, Guy S., Assistant Conservator of Forests, British East Africa.
*1908. BALCARRES, Lord, M.P., Balcarres, Fife.
*1884. BALFOUR OF BURLEIGH, The Right Hon. Lord, K.T., Kennet House, Alloa.
*1900. BALFOUR, Charles B., of Newton Don, Kelso.
*1886. BALFOUR, Edward, of Balbirnie, Markinch, Fife.
1906. BALFOUR, Frederick Robert Stephen, J.P., Dawyck, Stobo, Peeblesshire.
*1877. BALFOUR, Isaac Bayley, LL.D., Sc.D., M.D., F.L.S., Professor of Botany, Royal Botanic Garden, Edinburgh.
1892. BALLINGALL, Niel, Sweet Bank, Markinch, Fife.
*1904. BARBOUR, George Freeland, of Bonskeid, Pitlochry.
1897. BARCLAY, Robert Leatham, Banker, 54 Lombard Street, London, E.C.
1900. BARKER, Arthur, Forester, Limekiln Farm, Coddenham, near Ipswich.
1903. BARNES, Nicholas F., Head Gardener, Eaton Hall, Chester.
1907. BARR, John, Assistant Factor, Erskine, Bishopton.
*1866. BARRIE, James, Forester, Stevenstone, Torrington, North Devon.
*1895. BARRIE, James Alexander, Forester, Harlestone, Northampton.
1907. BARRON, Colin Campbell, Wood and Grain Merchant, Nairn Mills, Nairn.
*1889. BARRON, John, Elvaston Nurseries, Borrowash, Derby.
*1877. BARRY, John W., of Fyling Hall, Fylingdales, Scarborough, Yorks.
1874. BARTON, James, Forester, Hatfield House, Herts.
1904. BARTON, James Robert, Factor, 61 Frederick Street, Edinburgh.
1908. BAXTER, James, Gardener, Gorddinog, Llanfairfechan, Carnarvonshire.
*1903. BAZLEY, Gardner Sebastian, Hatherof Castle, Fairford, Gloucestershire.
1899. *Beatson, David J., 68 Southgrove Road, Sheffield.*
1904. BEAUMONT, Robert, Assistant Forester, c/o Mr Brown, Colliers End, North Ware, Herts.
*1897. BEGG, James, Rosslyne, Culter, by Aberdeen.
*1883. BELL, Andrew, Forester, Forglen, Turiff, Aberdeenshire.

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Date of Election.

1898. BELL, David, Seed Merchant, Coburg Street, Leith.
1907. BELL, David, Assistant Forester, Pilsley, Bakewell, Derbyshire.
1907. BELL, James, Assistant Forester, Abbeyleix, Queen's County, Ireland.
1900. BELL, Robert, Land Steward, Baronscourt, Newtown-Stewart, Ireland.
1898. BELL, R. Fitzroy, of Temple Hall, Coldingham.
1900. BELL, William, Forester, Balthayock, Perth.
*1871. BELL, William, of Gribdae, 181 Queen Victoria Street, London, E.C.
1895. BENNETT, J. B., C.E., A.M.I., 42 Frederick Street, Edinburgh.
1905. BENNETT, John, Forester and Acting Sub-Agent, Town's End, Wolverton, Basingstoke.
1903. BENTINCK, Lord Henry, M.P., Underley Hall, Kirkby Lonsdale.
1904. BERRY, Charles Walter, B.A., 11 Atholl Crescent, Edinburgh.
1889. BERRY, Francis, Forester, Minto, Hawick.
1903. BEVERIDGE, Erskine, LL.D., of Brucefield, St Leonard's Hill, Dunfermline.
1907. BEVERIDGE, James, Assistant Forester, Thoresby Park, Ollerton, Newark, Notts.
1903. BINNING, The Lord, Mellerstain, Kelso.
*1897. BLACK, Alexander, The Gardens, Carton, Maynooth, Co. Kildare.
1908. BLACK, Florence William, of Kailzie, Peeblesshire.
1904. BLACK, John, Factor, Cortachy Castle, Kirriemuir.
1908. BLAIR, Charles, Glenfoot, Tillicoultry.
1903. BLAIR, Thomas, Farmer, Hoprig Mains, Gladsmuir.
1872. BOA, Andrew, Estate Agent, Skates Hill, Glemsford, Suffolk.
*1877. BOLCKOW, C. F. H., of Brackenhoe, Marton Hall, Marton R.S.O., Yorks.
1892. BOND, Thomas, Forester, Lambton Park, Fence Houses, Durham.
*1895. BOORD, W. Bertram, Land Agent, Bewerley, Pateley Bridge, Yorks.
*1898. BORTHWICK, Albert W., D.Sc., Royal Botanic Garden, Edinburgh.
1898. BORTHWICK, Francis J. G., W.S., 9 Hill Street, Edinburgh.
1887. BOULGER, Professor, 11 Onslow Road, Richmond Hill, London, S.W.
1906. BOWMAN, John, Assistant Forester, Kincluny, Durris, Aberdeen.
1883. BOYD, John, Forester, Inverliever, Ford, Lochgilphead.
1897. BRAID, J. B., Forester, Witley Court, Great Witley, Worcester.
*1899. BRAID, Thomas, Factor, Durris, Drumoak, Aberdeenshire.
*1902. BRAID, William Wilson, Tossville, 12 Milton Road, Craigmillar Park, Edinburgh.
1907. BREADALBANE, Marchioness of, Black Mount, Bridge of Orchy, Argyleshire.
1907. BRODIE, Ian, of Brodie, Brodie Castle, Forres.
*1900. BROOM, John, Wood Merchant, Bathgate.
1905. *Brown, Alexander Shannon, Assistant Forester, 17 Henrietta Street, Kilmarnock.*
*1900. BROWN, Charles, Factor, Kerse, Falkirk.
1904. BROWN, George, Timber Merchant, Buckhaven Saw-mills, Buckhaven.
1905. BROWN, George H., Foreman Forester, Liverpool Corporation, Brinscall, Chorley, Lancashire.

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Date of Election.

1900. BROWN, Gilbert, Forester, Kiltarlity, Beauly.
1878. BROWN, J. A. Harvie-, of Quarter, Dunipace House, Larbert.
1899. BROWN, John, Forester and Ground Officer, Craighall, Rattray, Perthshire.
1893. BROWN, Robert, Forester, Boiden, Luss.
*1896. BROWN, Rev. W. Wallace, Minister of Alness, Ross-shire.
1895. BROWN, Walter R., Forester, Park Cottage, Heckfield, near Winchfield, Hants.
1900. BROWN, William, Forester, Lissadell, Sligo, Ireland.
1905. BRUCE, Alexander, Timber Merchant, 53 Bothwell Street, Glasgow.
1907. BRUCE, Charles, Assistant Forester, Harewood, Leeds.
1901. BRUCE, David, Forester, The Square, Dunnottar, Stonehaven.
*1895. BRUCE, Peter, Manager, Achnacloich, Culnadalloch, by Connel.
*1867. BRUCE, Thomas Rae, Old Garroch, New Galloway.
1904. BRUNTON, John, Foreman Forester, Woodville Cottage, Birr.
1907. BRYDEN, Thomas, Nurseryman, Dennison Nurseries, Ayr.
1897. BRYDON, John, Seed Merchant and Nurseryman, Darlington, Co. Durham.
*1873. BRYDON, John, Forester, Rothes, Elgin.
*1879. BUCCLEUCH, His Grace the Duke of, K.T., Dalkeith Palace, Dalkeith.
*1879. BUCHANAN, Charles, Overseer, Penicuik Estate, Penicuik.
1906. BURNETT, Sir Thomas, Bart., Crathes Castle, Crathes, N.B.
1899. BURN-MURDOCH, John, of Gartincaber, Doune.
1904. BUTLER, Robert, Forester, Chestnut House, Cockerton, near Darlington.
1906. BUTLER, Walter James, Assistant Forester, Mainhouse, Kelso.

1902. CADELL, Henry Moubray, of Grange and Banton, B.Sc., F.R.S.E., F.A.S., J.P., etc., Grange, Bo'ness.
1903. CAIRNS, Thomas, Forester, Lissduff House, Errill, Ballybrophy, Queen's County.
1906. CALDERHEAD, William, Overseer, Eredine, Port Sonachan, Argyleshire.
1905. CALLANDER, Gavin, Wood Merchant, Newton Stewart, Wigtownshire.
1901. CAMERON, Alex., Land Steward, Caledon Demesne, Caledon, Tyrone.
1907. CAMERON, Donald Walter, of Lochiel, Achnacarry, Spean Bridge.
1900. CAMERON, Dr James, The Fountain, Loanhead.
1902. CAMERON, Ewan, of Rutherford, West Linton.
1908. CAMERON, John, Forester, Isel Hall, Cockermouth, Cumberland.
*1899. CAMERON, John J., Norwood, Hamilton.
1904. CAMERON, Robert, Assistant Forester, The Mains, Dundas Castle, South Queensferry.
1907. CAMMACK, John, Hedger, Muirhouse, Falkirk.
1895. CAMPBELL, Alexander, Land Steward, Rosemill Cottage, Strathmartin, by Dundee.
1899. CAMPBELL, Alexander, Tullymully, Dunkeld.
1908. CAMPBELL, A. C. Carter, of Possil, Fascadale, Ardrishaig.
1902. CAMPBELL, Buchanan, W.S., 7 Lansdowne Crescent, Edinburgh.
1904. CAMPBELL, David S., Forester, Wilton Castle, Redcar, Yorks.

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Date of Election.

1905. CAMPBELL, Hugh A., Coachman and Gardener, Cunmont, by Dundee.
*1897. CAMPBELL, James Arthur, Arduaine, Lochgilphead, Argyleshire.
1900. CAMPBELL, James S., Forester, Ginsboro Hall, Ginsboro, Yorks.
1906. CAMPBELL, John, Land Steward, Forss Estates, Westfield, Thurso.
1908. CAMPBELL, Patrick William, of Auchairne, W.S., 25 Moray Place, Edinburgh.
1901. CAMPBELL, Peter Purdie, Factor, Lee and Carnwath Estates Office, Cartland, Lanark.
1908. CAMPBELL, Robert, B.Sc., Geological Laboratory, Edinburgh University.
1903. CANCH, Thomas Richard, B.Sc., P.A.S.I., 15 Riselaw Road, Morningside, Edinburgh.
*1903. CAPEL, James Carnegy, 34 Roland Gardens, London, S.W.
*1896. CARMICHAEL, Sir Thos. D. Gibson, Bart. of Castlecraig, Malleny House, Balerno.
1906. CARNEGIE, James, of Stronvar, Balquhidder.
1907. CARNEGIE, Robert, Assistant Forester, Craigo, by Montrose.
1903. CARRUTHERS, Major Francis John, of Dormont, Lockerbie.
*1898. CARSON, David Simpson, C.A., 209 West George Street, Glasgow.
1907. CASSELLS, Andrew, Assistant Forester, Bandon, Balbirnie, Markinch, Fife.
1904. CATHCART, Sir Reginald Gordon, Bart., Cluny Castle, Aberdeenshire.
1904. CAVERS, A. R. S., Estate Office, Benmore, Kilmun.
1904. CHADWICK, Robert, Findhorn House, Forres.
*1906. CHALCRAFT, George Barker, C.E., M.Inst.C.E., Swafield House, near North Walsham, Norfolk.
1897. CHALMERS, James, Overseer, Gask, Auchterarder, Perthshire.
1898. CHALMERS, James, Forester, Estate Office, Killin, Perthshire.
1904. CHALMERS, Robert W., Assistant Forester, Auchencrash Cottage, Glenapp Castle, Ballantrae.
1892. CHAPMAN, Andrew, Factor, Dinwoodie Lodge, Lockerbie, Dumfriesshire.
1892. CHAPMAN, Mungo, Torbrix Nurseries, St Ninians, Stirling.
1908. CHERNSIDE, Sir Herbert, Newstead Abbey, Nottingham.
1906. CHISHOLM, Alexander M'Kenzie, Clerk of Works, Dalkeith Park, Dalkeith.
1897. CHISHOLM, Colin, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links.
*1882. CHOWLER, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1884. CHRISTIE, Alex. D., 16 Oak Tree Lane, Selly Oak, Birmingham.
1906. CHRISTIE, Charles, Factor, Estate Office, Strathdon.
1906. CHRISTIE, Thomas, Nurseryman, Rosefield Nurseries, Forres.
*1883. CHRISTIE, William, Nurseryman, Fochabers.
1908. CHRYSTAL, Robert, Assistant Forester, Bowmont Forest, Roxburgh.
1890. CLARK, Charles, Forester, Cawdor Castle, Nairn.
1902. CLARK, Francis Ion, Estate Office, Haddo House, Aberdeen.
1891. CLARK, John, Forester, Haddo House, Aberdeen.

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Date of Election.

1906. CLARK, John, Forester, Almond Dell, Old Clapperton Hall, Midcalder.
1892. CLARK, William, 66 Queen Street, Edinburgh.
1902. CLARK, William, Assistant Factor, Raith, Kirkcaldy.
*1872. CLERK, Sir George D., Bart. of Penicuik, Midlothian.
*1902. CLINTON, The Right Hon. Lord, Fettercairn House, Fettercairn.
1906. CLYNE, James, Engineer, Knappach, Banchory.
*1898. COATS, Sir Thomas Glen, Bart., Ferguslie Park, Paisley.
1904. COBB, Herbert Mansfield, Land Agent, Higham, Rochester, Kent.
1896. *Cockburn, Alex. K., Assistant Forester, 51 High Street, Peebles.*
1906. COCKER, Alexander Morrison, Nurseryman, Sunnypark Nursery, Aberdeen.
*1904. COKE, Hon. Richard, Holkham, Norfolk.
1906. COLEBROOKE, Lord, Glengonnar, Abington, Lanarkshire.
1906. COLES, Walter G., Engineer, 122 George Street, Edinburgh.
1900. COLLIE, Alexander, Head Forester, Cholmondeley, Malpas, Cheshire.
1907. COLLIER, James, Assistant Forester, Estate Yard, Woodlawn, Co. Galway.
*1879. *Colquhoun, Andrew, 75 Buchanan Street, Glasgow.*
1908. COLSTON, William G., Estate Clerk, Rossie Estate Office, Inchture.
1908. COLTMAN, William Hew, J.P., B.A., Barrister, Blelack, Dinnet, Aberdeenshire.
1907. COMRIE, Patrick, Land Agent, Waterside, Dalry, Ayrshire.
1905. COMRIE, William Lewis, Factor, Cally Estates Office, Gatehouse.
1895. CONNOR, George A., Factor, Craigielaw, Longniddry.
*1887. COOK, James, Land Steward, Arniston, Gorebridge, Midlothian.
1906. COOK, Melville Anderson, Assistant Forester, Glamis, Forfarshire.
1904. COUPAR, Charles, Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.
*1897. COUPAR, Wm., Overseer, Balgowan, Perthshire.
1908. COUTTS, Wm., Forester, Gardener, and Ground Officer, Learney, Torphins, Aberdeen.
*1908. COWAN, Alexander, Valleyfield, Penicuik.
*1876. COWAN, Charles W., of Logan House, Valleyfield, Penicuik.
*1892. COWAN, George, 1 Gillsland Road, Edinburgh.
1858. COWAN, James, Forester, Bridgend, Islay, Argyleshire.
1899. COWAN, Robert, Chisholm Estates Office, Erchless, Strathglass.
*1901. COWAN, Robert Craig, Craigiebield, Penicuik.
*1874. COWPER, R. W., Gortanore, Sittingbourne, Kent.
*1904. COX, Albert E., of Dungarthill, Dunkeld.
*1904. COX, William Henry, of Snaigow, Murthly.
1900. CRABBE, Alfred, Forester, Craigo, Montrose (c/o Mrs Muirden, The Gardens).
1875. CRABBE, David, Forester, Byreburnfoot, Canonbie, Dumfriesshire.
1867. CRABBE, James, Forester, Glamis Castle, Forfarshire.
1904. CRAIG, Alexander, Assistant Forester, Glamis.
*1901. CRAIG, Sir James H. Gibson, Bart. of Riccarton, Currie.
*1875. CRAIG, Wm., M.D., C.M., F.R.S.E., 71 Bruntsfield Place, Edinburgh.

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Date of Election.

1903. CRANSTOUN, Charles Joseph Edmondstoune, of Corehouse, Lanark.
1899. CRERAR, David, Land Steward, Methven Castle, Perth.
1898. CRICHTON, William, Manager, Castle Ward, Downpatrick.
1907. CRITCHLEY, Edgar Godsell, Solicitor, 29 High Street, Inverness.
1903. CROLL, John, of D. & W. Croll, Nurseryman, Dundee.
1898. CROMBIE, James, Forester, c/o Mrs Goulder, Fawley, near Henley-on-Thames.
*1900. CROOKS, James, Timber Merchant, Woodlands, Eccleston Park, Prescot.
*1865. CROSS, David G., Forester, Kylisk, Nenagh, Ireland.
*1895. CROZIER, John D., Forester, Durris, Drumoak, Aberdeen.
1907. CRUICKSHANK, James, Farmer and Hotelkeeper, Port Erroll, Aberdeenshire.
1906. CUMMING, James, Manager, Glen Grant, Rothes.
1900. CUMMING, John H., Overseer, Royal Dublin Society, Ball's Bridge, Dublin.
1906. CUMMING, William, Nursery Foreman, Burnside Nurseries, Aberdeen.
*1901. CUNNINGHAM, Captain John, Leithen Lodge, Innerleithen.
1898. CUNNINGHAM, George, Advocate, 30 Queen's Gate Terrace, London, S.W.
*1893. CURR, W. S., Factor, Ninewar, Prestonkirk.
*1884. CURRIE, Sir Donald, K.C.M.G., M.P., of Garth Castle, Aberfeldy; 4 Hyde Park Place, London, W.
1907. CUTHBERTSON, Evan James, W.S., 3 Cumin Place, Edinburgh.

1907. DALE, Robert, Assistant Forester, Dean Road, Kilmarnock.
*1867. DALGLEISH, John G., of Ardnamurchan, Brankston Grange, Stirling.
*1906. DALGLEISH, Sir William Ogilvie, Bart., Errol Park, Errol.
*1900. DALHOUSIE, The Right Hon. the Earl of, Brechin Castle, Forfarshire.
1908. DALKEITH, The Earl of, Eildon Hall, St Boswells.
1901. DALRYMPLE, Hon. Hew H., Lochinch, Castle Kennedy, Wigtownshire.
*1906. DALRYMPLE, Lord, M.P., Lochinch, Stranraer.
1904. DALRYMPLE, The Right Hon. Sir Charles, Bart. of Newhailes, Musselburgh.
1901. DALZIEL, Henry, Assistant Forester, Cormiston Towers, Biggar.
1905. DAVID, Albert E., Assistant Forester, Pilsley, Bakewell, Derbyshire.
1905. DAVID, William J., Assistant Forester, Turgisgreen, Shewfield-on-Lodden, Basingstoke.
1908. DAVIDSON, David, Assistant Forester, Indian Head, Sask, Canada.
1904. DAVIDSON, James, 12 South Charlotte Street, Edinburgh.
1892. DAVIDSON, John, Forester, Dalzell, Motherwell, Lanarkshire.
*1892. DAVIDSON, William, Forester, Margam Park, Port Talbot, Wales.
1901. DAVIE, George, Overseer, Balruddery Gardens, near Dundee.
1904. DAVIE, Thomas, Assistant Forester, c/o Mrs Blair, Main Street, Cumbernauld, Glasgow.
1906. DAWSON, Herbert Thompson, The Nurseries, Knowsley.
*1908. DAWSON, William, M.A., B.Sc.(Agr.), Lecturer on Forestry, Marischal College, Aberdeen.

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Date of Election.

1904. DENHOLM, John, Timber Merchant, Bo'ness.
1907. DENTON, Edward George, Assistant Forester, Heckfield, Swallowfield, Berks.
1906. DENTON, Sydney, Assistant Forester, Bowood, near Calne, Wilts.
1906. DEWAR, Alex., Factor, Fasque Estates Office, Fettercairn.
1902. DEWAR, H. R., Forester, Beaufort Castle, Beauly.
*1901. DEWAR, John A., M.P., Perth.
1905. *Dewar, William, Assistant Forester, Fauldsley, Halliburton, Coupar-Angus.*
1904. DICK, William, Timber Merchant, Hamilton.
1908. DICKSON, John, Nurseryman, Dalkeith.
*1898. DIGBY, The Right Hon. Baron, Minterne, Cerne, Dorsetshire.
1904. DODDS, Thomas, Cashier, Pollok Estate Office, 216 West George Street, Glasgow.
*1903. DON, Alex., Namitomba Estate, Zomba, British Central Africa.
1901. *Donald, James Alexander, Assistant Forester, Cluny Square, Cardenden, Fife.*
1893. DONALDSON, James, Timber Merchant, Tayport, Fife.
1907. DONNE, Cyril Henry, Land Agent, Moor Park Estate Office, Rickmansworth, Herts.
*1896. DOUGLAS, Alex., Abbey Gardens, Wykeham R.S.O., Yorks.
1882. DOUGLAS, Captain Palmer, of Cavers, Hawick.
1904. DOUGLAS, James A., Assistant Forester, Ardgowan, Inverkip.
1887. DOUGLAS, Robert, 64 Princes Street, Edinburgh.
1903. DOUGLAS, William G., Forester, Ingleborough Estate, Clapham, Yorks.
1903. DOW, Alexander, Forester, Bretby Park, Burton-on-Trent.
1898. DOW, Thomas, Forester, Wakefield Lawn, Stony Stratford, Bucks.
1904. *Drummie, Alexander, Assistant Forester, c/o Mr I. Embleton, Linolds Wood Cottage, Hexham, Northumberland.*
1900. DRUMMOND, Dudley W., Commissioner, Cawdor Estate Office, Carmarthen, South Wales.
1904. DRUMMOND, William, Forester, West Grange, East Grange Station, Dunfermline.
1862. DRUMMOND & SONS, William, Nurserymen, Stirling.
1907. DUFF, John Wharton Wharton, of Orton and Barmuchity, Morayshire.
1903. DUFF, Mrs M. M. Wharton-, of Orton, Morayshire.
1907. DUFF, Thomas Gordon, of Drummuir and Park, Banffshire.
1907. DUGUID, Charles, Head Forester, Philorth, Fraserburgh.
*1883. DUNDAS, Sir Charles Henry, Bart. of Dunira, Crieff.
*1872. DUNDAS, Sir Robert, Bart. of Arniston, Gorebridge, Midlothian.
*1895. DUNDAS, Lieut.-Colonel Robert, Yr. of Arniston, Kirkhill, Gorebridge.
1907. DUNGLASS, Lord, Springhill, Coldstream.
1907. DUNLOP, George, W.S., 32 Abercromby Place, Edinburgh.
1905. DUNSTAN, M. I. R., Principal of South-Eastern Agricultural College, Wye, Kent.

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Date of Election.

*1902. DURHAM, Right Hon. the Earl of, Lambton Castle, Durham.
1873. DURWARD, Robert, Estate Manager, Blelack, Dinnet, Aberdeenshire.
1900. DUTHIE, James A., of Benjamin Reid & Co., Nurserymen, Aberdeen.

1898. EADSON, Thomas G., Forester, Whaley, Mansfield.
1885. EDDINGTON, Francis, Overseer, Monk Coniston Park, Lancashire.
1906. EDGAR, James, Factor, Poltalloch Estate Office, Lochgilphead.
1898. EDMINSON, Wm. D., Tweed View, Berwick-on-Tweed.
1904. EDMOND, James, Assistant, Wemyss Castle Estate Office, East Wemyss, Fife.
1899. EDWARDS, Alex. W. B., Forester, Thirlmere Estate, *via* Grasmere.
1893. ELDER, William, Forester, Thoresby, Ollerton, Newark, Notts.
1903. ELGAR, Walter Robinson, Land Agent, Hill House, Sittingbourne.
1902. ELLICE, Captain Edward Charles, Invergarry.
*1899. ELLISON, Francis B., Bragleenbeg, Kilninver, Oban.
*1904. ELPHINSTONE, The Lord, Carberry Tower, Musselburgh.
1901. ELWES, Henry John, F.R.S., of Colesborne, Cheltenham.
1901. ERSKINE, Richard Brittain, Oaklands, Trinity, Edinburgh.
1898. EWAN, Peter, Assistant Forester, Wood Cottage, Newland Park, Chalfont St Giles, Bucks.
1873. EWING, David, Forester, Strichen House, Aberdeen.
1904. EWING, Guy, Edenbridge, Kent.

1906. FAICHNEY, John, Assistant Forester, Blythswood, Renfrew.
1906. FAIRBAIRN, John, Assistant Forester, Söftlaw, Kelso.
1905. FARAGO, Adalbert, Forest Nurseries and Seed Establishment to His Majesty the Emperor, Zalaegerszeg, Hungary.
*1894. FARQUHARSON, James, Forester, Ardgowan, Inverkip.
1899. FAWCETT, Thos. G., Land Agent, Yarm-on-Tees.
1900. FEAKS, Matthew, Forester, Benmore, Kilmun.
1904. FENWICK, Andrew, Assistant Forester, Kinnaird Mill, Brechin.
1903. FENWICK, William, Factor, Darnaway Castle Estates Office, Earlsmill, Forres.
1908. FERGUSON, Donald, Joiner and Timber Merchant, Quarry Lane, Lennoxtown.
*1900. FERGUSON, James Alex., Ardnith, Partickhill, Glasgow.
*1888. FERGUSON, R. C. Munro, M.P., of Raith and Novar, Raith, Fife.
1899. FERGUSON, Sir J. E. Johnson, Bart. of Springkell, Ecclefechan.
1880. FERGUSSON, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1908. FERNIE, Alexander, Head Forester, Hopetoun, South Queensferry.
*1907. FERRIE, Thomas Young, Timber Merchant, 69 Buchanan Street, Glasgow.
*1901. FINDLAY, John Ritchie, of Aberlour, Aberlour House, Aberlour.
1893. FINLAYSON, Alexander, Ancrum Bridge, Jedburgh.
1893. FINLAYSON, Malcolm, Solicitor, Crieff, Perthshire.
1907. FISH, Andrew, Assistant Forester, Dean Road, Kilmarnock.
1869. FISHER, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.

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Date of Election.

1899. FISHER, W. R., Assistant Professor of Forestry, 6 Linton Road, Oxford.
*1902. FITZWILLIAM, Right Hon. the Earl of, Wentworth, Rotherham.
1899. FLEMING, John, Timber Merchant, Albert Saw-mills, Aberdeen.
*1906. FLETCHER, J. Douglas, of Rosehaugh, Avoch, Ross-shire.
1890. FORBES, Arthur C., Department of Agriculture, Dublin.
1898. FORBES, James, Factor, Blair Castle, Blair Atholl.
*1896. FORBES, James, The Gardens, Overtoun, Dumbartonshire.
*1878. FORBES, Robert, Estate Office, Kennet, Alloa.
1904. FORBES, Robert Guthrie, Forester, Cliff House, Gulworthy, Tavistock, Devon.
*1873. FORBES, William, Consulting Forester and Wood Surveyor, Lea Park, Blairgowrie.
1892. FORGAN, James, Sunnybraes, Largo, Fife.
*1869. FORGAN, James, Forester, Bonskeid, Pitlochry, Perthshire.
1889. FORSTER, William A., Forester, Belgrave Lodge, Pulford, Wrexham.
1904. FOSTER, Henry, Assistant Forester, Glenalmond, Methven.
1898. FOSTER, James, jun., Kennet Village, Alloa.
*1897. FOTHRINGHAM, W. Steuart, of Murthly, Perthshire.
*1866. FRANCE, Charles S., 13 Cairnfield Place, Aberdeen.
*1901. FRASER, Alexander, Solicitor and Factor, *Hon. Secretary and Treasurer, Northern Branch*, 63 Church Street, Inverness.
*1892. FRASER, George, Factor, Dalzell, Motherwell, Lanarkshire.
*1902. FRASER, George M., Estancia "La Selmira," Gualeguaychu, Argentine.
1898. FRASER, James, Assistant Forester, 10 Woodside Walk, Hamilton.
*1899. FRASER, James, Home Steward, Tregothnan, Truro.
1895. FRASER, J. C., Nurseryman, Comely Bank, Edinburgh.
1905. FRASER, John, Forester, The Little Hill, Leighton, Ironbridge R.S.O., Salop.
1901. FRASER, John M'Laren, of Invermay, Forgandenny, Perthshire.
1904. FRASER, Peter, Land Steward, Dalguise, Dunkeld.
1904. FRASER, Robert A., Cab Proprietor, 3 Sunbury Street, Edinburgh.
1907. FRASER, Robert S., Bunchrew House, Bunchrew, Inverness; Ivy House, Comshall, Surrey.
*1892. FRASER, Simon, Land Agent, Hutton in the Forest, Penrith.
*1907. FRASER, Sweton, Forester, Gallovie, Kingussie.
1896. FRATER, John, Foreman Forester, Ardross Mains, Alness, Ross-shire.
1902. FRATER, John, Head Forester, Ardross Castle, Alness, Ross-shire.
1907. FYFE, Harry Lessels, Assistant Forester, 10 Lilyhill Terrace, Edinburgh.
1906. *Fyfe, Robert, Assistant Gardener, Durris, Drumoak.*
1907. FYFFE, Robert Bullett, Factor, Aden Estates Office, Old Deer.
1899. FYSHE, Peter, Newtonlees, Dunbar.

1904. GALLOWAY, George, Quarrymaster, Roseangle, Wellbank, by Dundee.
*1893. GALLOWAY, Robert, S.S.C., *Secretary*, 19 Castle Street, Edinburgh.

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Date of Election.

1896. GAMMELL, Sydney James, of Drumtochty, Countesswells House, Bieldside, Aberdeen.
*1899. GARRIOCH, John E., Factor, Lovat Estates, Beauly.
*1907. GARSON, James, W.S., Albyn Place, Edinburgh.
*1903. GASCOIGNE, Lieut.-Col. Richard French, D.S.O., Craignish Castle, Ardfern, Argyleshire.
1898. GAULD, William, Forester, Coombe Abbey, Binley, Coventry.
1902. GAVIN, George, Factor, Falkland Estate, Falkland.
1900. GELLATLY, John, Forester, Newhall, by Penicuik.
1897. GELLATLY, Thomas, Forester, Hallyburton, Coupar Angus.
1906. GIBSON, Harry, Assistant Forester, Chatsworth, Pilsley, Bakewell.
1903. GIBSON, William, Assistant Forester, Carcary Hill, Farnell, Brechin.
1905. GILBERT, Alexander, Assistant Forester, Dalgety House, Donibristle, Aberdour.
*1881. GILCHRIST, Wm., Forester, Nursery Cottage, Mount Melville, St Andrews.
1897. GILLANDERS, A. T., F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
*1904. GILLESPIE, David, Advocate, of Mountquhanie, Cupar, Fife.
1894. GILLESPIE, James, Forester, Blairmore, Braco.
1894. GILMOUR, Major Robert Gordon, of Craigmillar, The Inch, Midlothian.
*1900. GLADSTONE, Sir John R., Bart. of Fasque, Laurencekirk.
1906. GLASS, James, Forester, Parkhead, Falkirk.
*1901. GODMAN, Hubert, Land Agent, Ginsborough, Yorkshire.
1903. GOLD, William, Forester, Dellavaird, Auchinblae.
1903. GOODAIR, James Stewart, Assistant Forester, Drumtochty, Fordoun.
1906. GORDON, Alex. M., J.P., D.L., of Newton, by Insch.
1904. *Gordon, Frank, Assistant Forester, Dean Road, Kilmarnock.*
1907. GORDON, John, Shipowner, Nairn.
1900. GORDON, Thomas, County Buildings, Edinburgh.
1907. GORMAN, Alfred W., Timber Merchant's Clerk, 126 Woodlands Road, Glasgow.
*1868. GOSSIP, James A., of Howden & Co., The Nurseries, Inverness.
*1897. GOUGH, Reginald, Forester, Wykeham, York.
1897. GOW, Peter, Land Steward, Laggan, Ballantrae, Ayrshire.
1897. GOW, Peter Douglas, Farmer, Bonaly, Colinton, Midlothian.
1905. GOW, Robert, Head Forester, Appin House, Argyleshire.
*1904. GRAHAM, Anthony George Maxtone, of Cultoquhey, Crieff.
1906. GRAHAM, David A., Teacher, 19 St Fillan's Terrace, Edinburgh.
1907. GRAHAM, Hugh Meldrum, Solicitor, Inverness.
1908. GRAHAM, James, Marquis of, Brodick Castle, Arran.
*1884. GRAHAM, Wm., 6 Royal Crescent, W., Glasgow.
1905. GRAHAM, William, Assistant Forester, The Bothy, Invertrossachs, Callander.
1887. GRANT, Alexander, Forester, Rothie-Norman, Aberdeenshire.
1867. GRANT, Donald, Forester, Drumin, Ballindalloch, Banffshire.
1908. GRANT, Donald, Forester, Fersit, Tulloch, Inverness-shire.

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Date of Election.

1904. GRANT, Ewan S., Foreman Forester, Chatsworth Estate, Bellsy, Rowsley, Derbyshire.
*1874. GRANT, John, Overseer, Daldowie, Tollcross, Glasgow.
1898. GRANT, John B., Forester, Downan House, Drumin, Glenlivet.
1907. GRANT, Robert, Muckrach Lodge, Dulnain Bridge, Inverness-shire.
1908. GRANT, Sir John Macpherson, Bart., Ballindalloch Castle, Ballindalloch.
1906. GRASSICK, William Henderson, Land Steward, Daviot Branch Asylum, Pitcaple, Aberdeenshire.
1907. GRAY, Alexander Reith, Merchant, Garthdee House, Cults.
1906. GRAY, David, Wheelwright, 270 Great Western Road, Aberdeen.
1907. GRAY, George, Foreman Forester, Brounshill, Colstoun Estate, Haddington.
1903. GRAY, Hon. Morton G. Stuart, of Kinfauns, Perth.
1901. GRAY, Major William Anstruther-, of Kilmany, Cupar, Fife.
1902. GRAY, Robert, Timber Merchant, Fraserburgh.
1902. GRAY, Walter Oliver, Foreman Woodman, Ladykirk, Berwickshire.
1908. GRAY, William, Assistant Forester, Pitfour Estates, Mintlaw Station, Aberdeenshire.
1906. GREIG, Robert Blyth, F.H.A.S., F.R.S.E., Marischal College, Aberdeen.
1898. GREY, The Right Hon. Sir Edward, Bart., M.P., of Falloden, Chathill, Northumberland.
1908. GRIEVE, J. W. A., Indian Forest Service, Branxholm Park, Hawick.
1903. GRIFFITHS, Sir Richard Waldie, of Hendersyde Park, Kelso.
*1905. GURNEY, Eustace, Sprowston Hall, Norwich.

1879. HADDINGTON, The Right Hon. the Earl of, K.T., Tyninghame, Prestonkirk.
*1900. HALDANE, William S., of Foswell, W.S., 55 Melville Street, Edinburgh.
1905. HALL, Thomas, Forester, Moore Abbey, Monasterevan, Co. Kildare.
1906. HALL, William, Head Forester, Tockwith, near York.
1904. HALLEY, John Y. (of Garvie & Syme), Ironmonger, etc., Perth.
1897. HALLIDAY, Geo., Timber Merchant, Rothesay.
1901. HALLIDAY, John, Timber Merchant, Rothesay.
1907. HAMILTON, Andrew, Naval Architect, 124 Shiel Road, Liverpool.
*1882. HAMILTON, Donald C., Forester, Knowsley, Prescot.
*1899. HAMILTON, The Right Hon. Baron, of Dalzell, Dalzell House, Motherwell.
1897. HAMILTON-OGILVY, H. T. M., of Beil, Prestonkirk, East Lothian.
1904. HANCOCK, Charles, M.A., Barrister-at-Law, Firlands, Grayshott, Hants; 125 Queen's Gate, London, S.W.
1892. HANNAH, George, Overseer, The Folly, Ampton Park, Bury St Edmunds, Suffolk.
1903. *Hannah, Thomas, Forester, Rendelsham Park, Woodbridge, Suffolk.*
1905. HANSON, Clarence Oldham, Deputy Conservator, Indian Forest Department, Latimer Lodge, Littledean Hill, Newnham, Gloucestershire.

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Date of Election.

1907. HARBEN, Henry Andrade, J.P., Newland Park, Chalfont St Giles, Bucks.
1907. HARBOTTLE, William, Assistant Forester, Harewood, Leeds.
*1903. HARDIE, David, Factor, Errol Park, Errol.
1903. *Hardy, Marcel Edgard, Assistant for Botany, University College, Dundee.*
*1880. HARE, Colonel, Blairlogie, Stirling.
1908. HARLAND, Henry, Park Forester, Sutton Coldfield, Warwickshire.
*1896. HARLEY, Andrew M., Forester, 19 Great Quebec Street, Marble Arch, London, W.
1905. HARROW, R. L., Head Gardener, Royal Botanic Garden, Edinburgh.
1897. HARROWER, William, Forester, Garth, Aberfeldy, Perthshire.
1897. HART, John, Factor, Mains of Cowie, Stonehaven, Kincardineshire.
*1880. HAVELOCK, W. B., The Nurseries, Brocklesby Park, Lincolnshire.
1905. HAY, Henry Ferguson, Assistant Forester, Cannon Hill Park, Birmingham.
1892. HAY, John, Overseer, Dollars Estate Office, 8 Rennie Street, Kilmarnock.
1904. HAY, Sir Duncan Edwyn, Bart. of Haystoun, 42 Egerton Gardens, London, S.W.
1906. HAY, Thomas, Head Gardener, Hopetoun House, South Queensferry.
1905. HAY, William Black, Assistant Forester, Nursery, Knowsley, Prescot.
1896. HAY, Wm. P., Merchant, Rosebank, Loanhead, Midlothian.
1889. HAYES, John, Overseer, Dormont, Lockerbie, Dumfriesshire.
1869. HAYMAN, John, Glentarff, Ringford, Kirkcudbrightshire.
1902. HAYNES, Edwin, Editor *Timber Trades Journal*, 164 Aldersgate Street, London.
1906. HENDERSON, Henry, Overseer, Bantaskin, Falkirk.
1907. HENDERSON, John, Assistant Forester, Gateside, Balbirnie, Markinch.
*1908. HENDERSON, John G. B., W.S., Nether Parkley, Linlithgow.
1901. HENDERSON, Peter, Factor, Ballindalloch.
1893. HENDERSON, R., 4 High Street, Penicuik, Midlothian.
1893. HENDERSON, William, Forester, Clonad Cottage, Tullamore, King's County.
*1906. HENDRICK, James, B.Sc., F.I.C., Marischal College, Aberdeen.
1898. HENDRY, James, 5 Thistle Street, Edinburgh.
1908. HENRY, Augustine, M.A., etc., Reader in Forestry, 23 Chesterton Road, Cambridge.
*1901. HEPBURN, Sir Archibald Buchan-, Bart. of Smeaton-Hepburn, Prestonkirk.
*1874. HERBERT, H. A., of Muckross, Killarney, Co. Kerry, Ireland.
*1884. HEYWOOD, Arthur, Glevering Hall, Wickham Market, Suffolk.
1907. HILL, Aaron Wylie, of Lemlair, Dingwall.
1895. HILL, Claude, of Messrs John Hill & Sons, Spot Acre Nurseries, Stone, Staffordshire.
1904. HILL, George, Assistant Forester, Fothringham, Forfar.
*1904. HILL, J. Smith, The Agricultural College, Aspatria.

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Date of Election.

*1903. HILL, Robert Wylie, of Balthayock, Perthshire.
*1905. HILLIER, Edwin L., F.R.H.S., Nurseryman and Landscape Gardener, Culross, Winchester.
*1902. HINCKES, Ralph Tichborne, J.P., D.L., Foxley, Hereford
1907. HINDS, John, Forester, Stockeld Park, Wetherby, Yorks.
1906. HISLOP, Robert, Assistant Forester, Chatsworth, Pilsley, Bakewell.
1895. HOARE, Sir Henry Hugh Arthur, Bart. of Stourhead, Bath.
1903. HODSON, Richard Edmund, Land Agent, Coolfadda House, Bandon, Co. Cork.
1866. HOGARTH, James, Forester, Culhorn, Stranraer, Wigtownshire.
1908. HOGG, Alexander, Assistant Forester, Nibbetstane, Durris, Drumoak.
1905. HOGG, Richard, Estate Overseer, Glenapp, Ballantrae, Ayrshire.
*1905. HOLMS, John A., Formaken, Erskine, Renfrewshire.
*1902. HOOD, Thomas, jun., Land Agent, Bogend, Duns.
*1871. HOPE, H. W., of Luffness, Drem, Haddingtonshire.
1907. HOPKINSON, James Garland, Factor, Drumtochty Estates Office, 11a Dee Street, Aberdeen.
*1876. HORSBURGH, John, Aberdour House, Aberdour, Fife.
1902. HOWE, John Arnold, Assistant Forester, Kippendavie, Dunblane.
*1905. HUDSON, W. F. A., M.A., Lecturer on Forestry, Agricultural College, Glasgow.
1876. HULL, Frank, Forester, Lilleshall, Newport, Salop.
1905. HUTTON, George Kerse, Assistant Forester, Castle Kennedy, Wigtownshire.
1906. HUTTON, James, Head Forester, Glendye, Banchory.

1905. IMRIE, Charles, Assistant Forester, The Nursery, Knowsley, Prescot.
1901. IMRIE, James, Assistant Forester, Knowsley, Prescot, Lancashire.
*1884. *Inglis, Alex., Greenlaw Dean, Greenlaw, Berwickshire.*
*1908. INGLIS, Alexander Wood, of Glencorse, Loganbank, Milton Bridge.
*1904. INGLIS, David, Accountant, National Bank, Allanmore, Abbotshall Road, Kirkcaldy.
1897. INGLIS, George Erskine, Estate Agent, Campbeltown, Argyleshire.
1891. INGLIS, William, Forester, Brodick, Isle of Arran.
1895. INNES, Alexander, Forester, Drummuir, Keith.
1904. INNES, Alexander Berowald, of Raemoir and Dunnottar, Raemoir House, Banchory.
1901. INNES, George, Cothall, Altyre, Forres.
1906. INNES, James, Wood Merchant, Sundayswells Saw-mills, Torphins.
*1906. IRVINE, Alexander Forbes, J.P., B.A.(Oxon.), Drum Castle, Aberdeen.
1904. IRVINE, Cosmo Gifford, Assistant Forester, Hollycombe Estate, c/o Mrs Luckins, Wardley Marsh, Liphook, Hants.
1901. IRVINE, John, Assistant Forester, Colesborne, Cheltenham, Gloucestershire.
1906. IRVING, James Rae Anderson, Foreman Forester, Dalzell Farm Motherwell.

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Date of Election.

1907. JACK, David, Assistant Forester, Camis Eskan, Helensburgh.
1893. JACK, George, S.S.C., Dalkeith, Midlothian.
*1906. JACKSON, George Erskine, B.A.(Oxon.), W.S., Kirkbuddo, Forfar.
1895. JAMIESON, Andrew, Overseer, Carnbroe, Bellshill.
1898. JAMIESON, James, Forester, Ynyslas, Llanarthney R.S.O., Carmarthenshire.
1896. JARDINE, Sir R. W. B., Bart. of Castlemilk, Lockerbie, Dumfriesshire.
1907. JERVOISE, Francis Henry Tristram, J.P., Herriard Park, Basingstoke.
1904. JOANNIDES, Pericles, Student of Forestry, Willesden, Sporting Club Station, Ramlek, Egypt; and 4 Merchiston Place, Edinburgh.
1901. *Johnston, Andrew Reid, Assistant Forester, c/o Mrs Vickers, Pilsley, Bakewell.*
1899. JOHNSTON, Edward, Forester, Dalquharran, Dailly, Ayrshire.
*1901. JOHNSTON, James, F.S.I., Factor, Alloway Cottage, Ayr.
*1883. JOHNSTON, Robert, Forester, Bon Ryl Estate, Duns, Berwickshire.
1907. JOHNSTON, Robert, Forester, Dalkeith Park, Dalkeith.
*1907. JOHNSTONE, Richard, Forester, The Glen, Innerleithen.
1900. JOHNSTONE, William, Head Forester, Beil, Prestonkirk.
*1882. JONAS, Henry, Land Agent and Surveyor, 23 Pall Mall, London, S.W.
1902. JONAS, Robert Collier, Land Surveyor, 23 Pall Mall, London.
1903. JONES, Ireton Arthur, of Kennick & Co., Delgany Nurseries, Co. Wicklow.
1888. JONES, James, Wood Merchant, Larbert, Stirlingshire.
1893. JONES, Thomas Bruce, Wood Merchant, Larbert.

1867. KAY, James, Wood Manager, Bute Estates, Rothesay.
1907. KAY, James, Nursery Station, Indian Head, Sask, Canada.
1904. KAY, William, Grain Merchant, Lasswade.
1904. KEIR, Alexander, Assistant Forester, Seafield Cottage, St Davids, Inverkeithing.
1896. KEIR, David, Forester, Ladywell, Dunkeld.
1906. KEIR, James, Forester, Raith, Kirkcaldy.
*1901. KENNEDY, Frederick D. C.-Shaw-, Dyroch, Maybole.
*1890. KENNEDY, James, Doonholm, Ayr.
1906. KENNEDY, Stewart Winter, Assistant Forester, Glamis.
1899. KENNEDY, Thomas, Assistant Forester, Lambton Park, Fence Houses, Durham.
1904. KENNEDY, Colonel Watson, Wiveton Hall, Cley, Norfolk.
1906. KENNEDY, William Gorman, Timber Merchant, 48 West Regent Street, Glasgow.
1901. KENT, William, Forester, Burnfoot, Barskimming, Mauchline.
*1892. KERR, John, Farmer, Barney Mains, Haddington.
1896. KETTLES, Robert, Assistant Forester, Craigend, Perth.
1907. KIDD, John, Assistant Forester, Heckfield, Winchfield, Hants.
1894. KIDD, Wm., Forester, Harewood, Leeds.
*1908. KIMMETT, John, Forester, The Lodge, Glenstriven, Toward, Argyleshire.
1879. KINCAIRNEY, The Hon. Lord, 6 Heriot Row, Edinburgh.
1900. KING, David, Nurseryman, Osborne Nurseries, Murrayfield.

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Date of Election.

*1906. KINLOCH, Charles Y., of Gourdie, by Murthly.
1901. KINLOCH, Sir John G. S., of Kinloch, Meigle.
*1903. KINNAIRD, The Hon. Douglas A., Master of Kinnaird, 10 St James Square, London.
1906. KINNEAR, Alexander T., Wood Manager and Forester, Jeaniebank House, Old Scone, Perth.
1905. KINROSS, D. A., Farmer, Hillend, Clackmannan.
*1898. KINROSS, John, Architect, 2 Abercromby Place, Edinburgh.
*1902. KIPPEN, William James, Advocate, B.A., LL.B., Westerton, Balloch, Dumbartonshire.
1898. KYLLACHY, The Hon. Lord, of Kyllachy, 6 Randolph Crescent, Edinburgh.

1907. LAING, John, Wood Merchant, Inverness.
1907. LAIRD, Charles, Assistant Forester, Home Farm, Dalzell, Motherwell.
1898. LAIRD, James W., Nurseryman, Monifieth.
1907. LAIRD, John, Forester, Powerscourt, Enniskerry, Co. Wicklow.
*1896. LAIRD, Robert, Nurseryman, 17a South Frederick Street, Edinburgh.
*1901. LAMB, Alexander, Overseer, Freeland, Forgandenny.
*1894. LAMINGTON, The Hon. Lord, G.C.M.G., Lamington, Lanarkshire.
1899. LAMOND, Alexander, Forester, Freeland, Forgandenny.
*1905. LAMONT, Norman, M.P., of Knockdow, Toward, Argyleshire.
*1906. LANGLANDS, James H., Cunmont House, by Dundee.
*1896. LANSDOWNE, The Most Hon. the Marquess of, K.G., 54 Berkeley Square, London, S.W.
1906. LAUDER, Alexander, D.Sc., Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh.
1901. LAUDER, William, Steward, Summerhill House, Enfield, Co. Meath.
1897. LAURISTON, John, Assistant Forester, c/o Mrs Pickering, Holbeck, Woodhouse, Welbeck, Worksop, Notts.
1906. LAWSON, William, Assistant Factor, Cromartie Estates, Kildary, Ross-shire.
1902. LEARMONT, John, Nurseryman, Larchfield Nurseries, Dumfries.
1904. LEES, D., of Pitscottie, Cupar, Fife.
1905. LEES, Ernest A. G., Assistant Factor, Durris Estate, by Aberdeen.
*1876. LEICESTER, The Right Hon. the Earl of, Holkham Hall, Wells, Norfolk.
1880. LEISHMAN, John, Manager, Cavers Estate, Hawick, Roxburghshire.
1908. LESLIE, Archibald Stewart, W.S., Factor to Colonel A. G. Leslie of Kininvie, etc., 33 Queen Street, Edinburgh.
*1868. LESLIE, Charles P., of Castle-Leslie, Glaslough, Ireland.
*1893. LEVEN, George, Forester, Auchincruive, Ayr.
*1881. LEYLAND, Christopher, Haggerston Castle, Beal, Northumberland.
1898. *Leys, Wm. B., Forester, Colstoun Old Mill, Gifford, East Lothian.*
1907. LINDSAY, Hugh, Head Forester, Torwoodlee Estate, Galashiels.
1879. LINDSAY, Robert, Kaimes Lodge, Murrayfield, Midlothian.
1907. LINDSAY, William, of Messrs J. & H. Lindsay, Ltd., Tourist Agents, 18 St Andrew Street, Edinburgh.
1905. LOGAN, David, Factor, Saltoun, Pencaitland.

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Date of Election.

1908. LOGUE, Hugh, Forester, Knockdow, Toward, Argyleshire.
*1883. LONEY, Peter, Estate Agent, 6 Carlton Street, Edinburgh.
1906. LONGMUIR, Alexander Law, Assistant Forester, Denhead, Fern, Brechin.
*1881. LONSDALE, Claud, Rose Hill, Carlisle.
1908. LOUDON, Thomas, Assistant Forester, Indian Head, Sask, Canada.
1907. LOUTIT, Rev. John Smeaton, Minister of Foveran, Manse of Foveran, Aberdeen.
*1898. LOVAT, The Right Hon. Lord, C.B., D.S.O., Beaufort Castle, Beauly, Inverness.
*1880. *Love, J. W., c/o Mrs Boyce, Byron Street, St Kilda, Victoria, South Australia.*
*1875. LOVELACE, The Right Hon. the Earl of, East Horsley Towers, Woking, Surrey.
1898. LOW, James, Forester, Innes Estate, Elgin.
*1900. LOW, William, B.Sc., Tighnamuirn, Monifieth.
1906. LUMSDEN, David, Assistant Forester, Pitkellony Lodge, Muthill, Perthshire.
*1891. LUMSDEN, Hugh Gordon, of Clova, Lumsden, Aberdeenshire.
1900. LUMSDEN, Robert, jun., 11 Morningside Terrace, Edinburgh.
*1875. LUTTRELL, George F., of Dunster Castle, Taunton, Somersetshire.
*1900. LYELL, Sir Leonard, Bart. of Kinnordy, Kirriemuir.

*1907. M'AINSH, Duncan, Wood Merchant, Crieff.
1906. MACALPINE-LENY, Major R. L., of Dalswinton, Dumfriesshire.
1902. *MacArthur, William, Assistant Forester, Queen Street, Waddesdon, Aylesbury, Buckinghamshire.*
1907. M'BAIN, William, Forester, Estates Office, Drumnadrochit.
*1892. MACBEAN, Simon, Land Steward, Erskine, Bishopton.
1896. M'BEATH, David, Forester, Brinscall, Chorley, Lancashire.
1908. M'CALLUM, Alexander, Assistant Forester, East Lodge, Dunira, Comrie, Perthshire.
1894. M'CALLUM, Edward, Overseer, Kerse Estate, Falkirk.
1903. M'CALLUM, Hugh, Forester, Annandale Estates, Lockerbie.
1898. M'CALLUM, James, Forester, Canford, Wimborne, Dorset.
*1901. M'CALLUM, Thomas W., Retired Ground Officer, Dailly, Ayrshire.
1904. M'CLELLAN, Frank C., Zanzibar Government Service, Pemba, *via* Zanzibar, East Africa.
*1870. M'CORQUODALE, D. A., Bank of Scotland, Carnoustie, Forfarshire.
1893. M'COUBRIE, M. S., Land Steward, Tullamore, King's County, Ireland.
1899. M'DIARMID, Hugh, Assistant Forester, Courtworth Lane, Wentworth, Rotherham.
1900. MACDIARMID, Hugh, Factor, Island House, Tiree, Oban.
1904. MACDONALD, Alexander, Factor, Meggernie, Aberfeldy.
1907. MACDONALD, Alexander, Farmer, Rhives, Delny.
1908. M'DONALD, Donald, Assistant Forester, Bowmont Forest, Roxburgh.
1902. *Macdonald, Donald M'Intosh, Assistant Forester, Budby, Ollerton, Newark, Notts.*

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1901. MACDONALD, Mrs Eleanor E., The Manse, Swinton.
1893. MACDONALD, George U., Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
*1900. MACDONALD, Harry L., of Dunach, Oban.
*1894. MACDONALD, James, Forester, Kinnaird Castle, Brechin.
1897. M'DONALD, James N. B., Forest Nursery Station, Indian Head, Sask, Canada.
1903. MACDONALD, James Farquharson, S.S.C. and N.P., Kilmuir, Linlithgow.
1895. MACDONALD, John, Forester, Skibo, Dornoch.
1908. M'DONALD, John, Foreman Forester, Culzean Estate, Maybole.
1907. M'DONALD, Robert Gregor, 3 Mill Road, Nairn.
1907. MACDONALD, T. Martin, of Barguillean, Taynuilt.
1906. MACDONALD, William Kid, Windmill House, Arbroath.
1904. M'DONALD, William Yeats, of Auquharney, Hatton, Aberdeenshire.
1894. M'DOUGALL, Alex., Forester, Tuncombe Park, Helmsley R.S.O., Yorks.
1907. MACDOUGALL, James, Assistant Forester, Pollok Estate, Pollokshaws.
1902. MACDOUGALL, John, 16 St Andrew Square, Edinburgh.
*1895. MACDOUGALL, Professor Robert Stewart, M.A., D.Sc., 13 Archibald Place, Edinburgh.
*1884. MACDUFF, Alex., of Bonhard, Perth.
1906. M'EWAN, James, Assistant Forester, Glamis.
1904. *M'Ewan, James, Assistant Forester, Abercairney, Crieff.*
1904. M'EWAN, Wm., Assistant Forester, Kingswood, Murthly.
1901. MACEWEN, Alexander, Overseer, Castle Lachlan, Strachur, Inveraray.
1898. MACFADYEN, Donald, Assistant Forester, Drumlanrig, Thornhill.
1907. MACFARLANE, Archibald, Timber Merchant, Harbour Saw-mills, Paisley.
*1904. MACFIE, John William, of Dreghorn, Rowton Hall, Chester.
*1901. M'GARVA, Gilbert Ramsay, Factor, Estate Office, Innes, Elgin.
1901. M'GHIE, John, Overseer, Kelburne Estate, Fairlie.
*1901. M'GIBBON, Donald, Forester, Rossie Estate, Inchture.
1904. M'GIBBON, R., Forester, Wentworth, Rotherham.
*1902. MACGREGOR, Alasdair Ronald, Edinchip, Lochearnhead.
1890. M'GREGOR, Alex., Jackson Street, Penicuik, Midlothian.
1902. M'GREGOR, Alexander, Forester, Abbeyleix, Queen's Co.
1896. M'GREGOR, Angus, Forester, Craigton, Butterstone, Dunkeld.
1899. M'GREGOR, Archibald, Forester, Airthrey Castle, Bridge of Allan.
*1906. MACGREGOR, Evan Malcolm, Factor, Ard Choille, Perth.
1904. M'HAFFIE, John A., Saw-mill Manager, 31 Windle Street, St Helens, Lancashire.
1899. M'HARDY, Alexander, The Castle, Inverness.
1905. M'HARDY, James, Forester, Rosehaugh Estate, Avoch R.S.O., Ross-shire.
1906. M'HARDY, Peter, Seedsman, 30 Guild Street, Aberdeen.
1904. M'HARDY, William, Forester, Chancefield, Falkland, Fife.
1901. M'HATTIE, John W., City Gardener, City Chambers, Edinburgh.

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1894. M'Ilwraith, Wm., Forester, Riddell, Lilliesleaf, Roxburghshire.
1907. M'Innes, William, Assistant Forester, Advie, Strathspey.
1905. M'Intosh, Alexander, Assistant Forester, Parkhead, Hopetoun, South Queensferry.
*1895. Macintosh, D. L., The Gardens, Stronvar, Lochearnhead.
*1879. M'Intosh, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1904. M'Intosh, Robert, Forester, Cullentragh Cottage, Rathdrum, Co. Wicklow.
*1885. MacIntosh, William, Fife Estates Office, Banff.
1901. Macintosh, William, Forester, New Chapel, Boncath R.S.O., South Wales.
1905. M'Intyre, Archibald, Timber Merchant, Glenlee, Cardross.
1907. M'Intyre, Charles, Forester, Inver, Dunkeld.
1898. Mackay, Æneas J. G., LL.D., Advocate, 2 Albyn Place, Edinburgh.
1892. M'Kay, Allan, c/o Park & Co., Ltd., Timber Merchants, Fraserburgh.
1865. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1899. M'Kay, John, Forester, Newe Estates, Strathdon.
1908. M'Kay, Murdo, Forester, Castlecomer, Co. Kilkenny.
1887. Mackay, Peter, Forester and Overseer, Bargany Mains, Dailly, Ayrshire.
1907. Mackay, William, Factor, Chisholm Estates, 19 Union Street, Inverness.
1900. M'Kechnie, Angus, Assistant Forester, Walkergate, Alnwick.
1891. Mackendrick, James, Forester, Estate Office, Pallas, Loughrea, Co. Galway.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1904. Mackenzie, Sir Alexander Muir, Bart. of Delvine, c/o Messrs Condie, Mackenzie & Co., W.S., Perth.
1907. Mackenzie, Sir Arthur, Bart. of Coul, Strathpeffer.
1901. Mackenzie, Charles, Factor, Clunes, Achnacarry, Spean Bridge.
1901. M'Kenzie, Daniel, Forester, Wynyard Estate, Stockton-on-Tees.
*1872. Mackenzie, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh.
1904. Mackenzie, Major E. Walter Blunt, Castle Leod, Strathpeffer.
*1893. Mackenzie, James, Forester, Cullen House, Cullen.
1899. M'Kenzie, James, Wood Merchant, Carr Bridge, Inverness-shire.
1897. Mackenzie, John, Forester, Holmhead, Daljarrock, Ayrshire.
1907. Mackenzie, John, jun., Factor, Dunvegan, Skye.
1900. Mackenzie, Sir Kenneth John, Bart. of Gairloch, 10 Moray Place, Edinburgh.
1908. Mackenzie, Nigel Banks, Factor, Fort William.
1908. Mackenzie, Nigel Blair, Assistant Factor, Fort William.
1907. Mackenzie, Colonel Stewart, of Seaforth, Brahan Castle, Dingwall.
1907. Mackenzie, W. Dalziel, of Farr, Inverness.
1896. Mackenzie, Wm., Forester, Novar, Evanton, Ross-shire.

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1905. M'KERCHAR, John, Commercial Traveller and Seedsman, 35 Giesbach Road, Upper Holloway, London, N.
*1897. *M'Kerrow, Robert, Manager, Carton, Maynooth, Co. Kildare.*
1907. MACKEZZACK, George Ross, of Ardgye, Elgin.
*1898. MACKINNON, A., The Gardens, Scone Palace, Perth.
1883. MACKINNON, George, The Gardens, Melville Castle, Lasswade.
1902. MACKINNON, John, Gardener, Terregles, Dumfries.
1907. MACKINNON, Robert, Forester, Smithton, Culloden.
1878. MACKINTOSH, The, of Mackintosh, Moy Hall, Inverness.
*1905. MACKINTOSH, W. E., Yr. of Kyllachy, 28 Royal Circus, Edinburgh.
*1895. MACLACHLAN. John, of Maclachlan, 12 Abercromby Place, Edinburgh.
1904. MACLAGGAN, George C. R., Forester, Munday Cottages, Aberdalgie.
1903. MACLAGGAN, John G., Overseer, Lethendy Cottage, Glenalmond, Perthshire.
1901. M'LAREN, Donald, Overseer, Sundrum, by Ayr.
1908. M'LAREN, James, Sub-Agent, Haggerston, Beal, Northumberland.
*1879. M'LAREN, John, 12 Findhorn Place, Edinburgh.
*1898. MACLEAN, Archibald Douglas, J.P., Harmony, Balerno.
1906. M'LEAN, James Smith, Assistant Forester, Douglas, Lanarkshire.
1902. MACLEAN, Peter, Forester, Invergarry.
1898. M'LENNAN, John, The Gardens, Castle Boro, Enniscorthy, Co. Wexford.
1901. M'LEOD, Peter, Nurseryman, Perth.
1903. M'MILLAN, Duncan H., Assistant Forester, Houston, Renfrewshire.
1895. MACMILLAN, John D., Steward, The Farm, Ganston Manor, Abbeyleix, Queen's Co.
*1904. M'NAB, David Borrie, Solicitor, Clydesdale Bank, Bothwell.
1903. M'NAUGHTON, George, Assistant Forester, Duncrub Park, Dunning, Perth.
1903. M'NAUGHTON, John, Forester, Auchterarder House, Perth.
1906. MACNICOLL, David Greenhill, Assistant Forester, Glamis.
1906. MACNICOLL, Frank, Assistant Forester, Glamis.
1902. M'OMISH, John, Nurseryman, Crieff.
1907. MACPHERSON, C. J. B., of Balavil, Kingussie.
1901. MACPHERSON, Duncan, Assistant Forester, Hawkhill Cottage, Alloa Park, Alloa.
1890. M'RAE, Alexander, Forester, Buckhill Cottages, Calne, Wilts.
*1899. MACRAE-GILSTRAP, Major John, of Ballimore, Otter Ferry, Argyleshire.
1900. M'RAE, Henry, Assistant Forester, c/o Mrs Todd, Harewood Estate, Leeds.
1908. M'RAE, John, Assistant Forester, Goddards Green, Mortimer, Berks.
1908. MACRAE, Sir Colin G., W.S., 45 Moray Place, Edinburgh.
1906. MACRAE, John, Forester, Highfield, Muir of Ord, Ross-shire.
1907. M'RAW, Donald, Manager, Strathgarve, Garve R.S.O.
*1879. MACRITCHIE, David, C.A., 4 Archibald Place, Edinburgh.
1895. M'TAVISH, John, Assistant Forester, The Glen, Skelbo, Sutherland.
1905. M'VINNIE, Samuel, Forester, Skeagarvie, Rossmore Park, Monaghan.
1884. *Main, Adam, Forester, Loftus R.S.O., Yorkshire.*

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*1905. MAITLAND, A. D. Steel, of Sauchie, etc., Sauchieburn, Stirling.
*1880. MALCOLM, Lieut.-Col. E. D., R.E., Achnamara, Lochgilphead.
1907. MALKIN, Herbert C., J.P., 46 Phillimore Gardens, Kensington, W.
*1895. MANN, Charles, Merchant, Lumsden, Aberdeenshire.
*1898. MANSFIELD, The Right Hon. the Earl of, Scone Palace, Perth.
1896. MAR AND KELLIE, The Right Hon. the Earl of, Alloa House, Alloa.
*1895. MARGERISON, Samuel, English Timber Merchant, Calverley, near Leeds.
*1901. MARSHALL, Archd. M'Lean, Crogen, Corwen, North Wales.
1902. MARSHALL, George, Broadwater, Godalming, Surrey.
*1905. MARSHALL, Henry Brown, of Rachan, Broughton.
1899. MARSHALL, John, Timber Merchant, etc., Maybole.
1893. MARSHALL, J. Z., Timber Merchant, 2 Dean Terrace, Bo'ness.
1907. MARSHALL, William, Assistant Forester, Harewood, Leeds.
*1876. MARTIN, James, Forester, Knipton, Grantham, Lincolnshire.
*1884. MASSIE, W. H., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1907. MASSON, William, Forester, Hamilton Lodge, Melton Mowbray, Leicestershire.
1906. MASTERTON, James, Wood Merchant, 4 Windsor Street, Edinburgh.
1893. MATHER, R. V., of Laing & Mather, Nurserymen, Kelso.
1901. MATTHEWS, Robert, Land Steward, Duncrub Park, Dunning.
*1894. MAUGHAN, John, Estate Agent, Jervaulx Abbey, Middleham R.S.O., Yorks.
1907. *Maw, Percival Trentham, Professor of Forestry, Royal Agricultural College, Cirencester.*
1907. MAXTONE, James, Overseer, Strathallan, Machany, Perthshire.
1896. MAXTONE, John, Forester, Duff House, Banff.
*1904. MAXWELL, Aymer, Yr. of Monreith, Wigtownshire, Lieutenant, Grenadier Guards.
1891. MAXWELL, James, Forester and Overseer, Ruglen, Maybole.
*1893. MAXWELL, Sir John Stirling-, Bart. of Pollok, Pollokshaws.
1886. MAXWELL, The Right Hon. Sir Herbert E., Bart. of Monreith, Port William, Wigtownshire.
1905. MAXWELL, William Jardine Herries, of Munches, Dalbeattie.
1907. MEACHER, Sydney George, Land Agent, Marlee, Blairgowrie.
1896. MEIKLEJOHN, John J. R., Factor, Novar, Evanton, Ross-shire.
1906. MELDRUM, Thomas C., Nurseryman, Forfar.
1899. MELVILLE, David, The Gardens, Dunrobin Castle, Golspie.
1901. MENZIES, James, Assistant Forester, Dollardstown Nursery, Wageney, Carlow.
*1908. MENZIES, William Dudgeon Graham, J.P., Hallyburton, Coupar Angus.
*1880. MESHAM, Captain, Pontryffydd, Bodvari, Rhyl, Denbighshire.
1906. MESTON, William, Assistant Forester, Tower Cottage, Durris, Aberdeen.
1877. METHVEN, Henry, of Thomas Methven & Sons, 15 Princes Street, Edinburgh.
1869. METHVEN, John, of Thomas Methven & Sons, Leith Walk Nurseries, Edinburgh.

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1892. METHVEN, John, The Gardens, Blythswood, Renfrewshire.
*1881. MICHIE, John, M.V.O., Factor, Balmoral, Ballater, Aberdeenshire.
1893. MICHIE, William, Forester, Welbeck, Worksop, Notts.
*1893. MIDDLEMASS, Archibald, Forester, Tulliallan, Kincardine-on-Forth.
1905. MIDDLETON, James, Factor, Braehead House, Kilmarnock.
*1905. MILLAR, John, Timber Merchant, Greenhaugh Saw-mills, Govan.
1905. MILLER, Lewis, of Corriegour, Inverness-shire, and Timber Merchant, Benochie, Crieff.
1882. MILNE, Alex., of James Dickson & Sons, 46 Hanover Street, Edinburgh.
1899. MILNE, Alexander, Factor, Urie Estate Office, Stonehaven.
1902. MILNE, Alexander, Forester, Charboro' Park, Wareham, Dorset.
1903. MILNE, Colonel George, of Logie, Aberdeenshire.
1904. MILNE, Frederick, Assistant Forester, Nursery Cottage, Tarbrax, by Forfar.
1895. MILNE, James, Land Steward, Carstairs House, Carstairs.
1906. MILNE, John, Assistant Forester, Woodlands, Durris, Aberdeen.
1899. MILNE, Ritchie, Assistant, Annandale Estate Office, Hillside, Lockerbie.
*1898. MILNE, Robert P., Spittal Mains, Berwick-on-Tweed.
1890. MILNE, William, Farmer, Foulden, Berwick-on-Tweed.
1902. MILNE, William, Forester, Huntly Hill, Stracathro, Brechin.
1906. MILNE, William, Nurseryman (Wm. Fell & Co., Ltd.), Hexham.
1901. MILNE-HOME, David William, of Wedderburn, Caldra, Duns.
*1897. MILNE-HOME, J. Hepburn, Irvine House, Canonbie.
1894. MILSOM, Isaac, Gardener and Steward, Claydon Park, Winslow, Bucks.
1904. MITCHELL, Alexander, Forester, Dalmeny Park, Edinburgh.
1898. MITCHELL, David, Forester, Drumtochty, Fordoun.
*1882. MITCHELL, Francis, Forester, Woburn, Beds.
1904. MITCHELL, James, Organising Secretary for Technical Education to Fife County Council, County Buildings, Cupar, Fife.
*1902. MITCHELL, John, jun., Timber Merchant, Leith Walk Saw-mills, Leith.
1904. MITCHELL, John Irvine, M.A., Teacher, 3 Grange Road, Edinburgh.
1901. MITCHELL, William Geddes, Estate Agent, Doneraile, Co. Cork.
1903. MOERAN, Archibald E., Land Agent, etc., Palmerston House, Portumna, Co. Galway.
1902. MOFFAT, John, Forester, Blackwood, Lesmahagow.
1908. MOIR, William Mortimer, Forester and Gardener, The Gardens, Rosehaugh, Avoch, Ross-shire.
*1908. MOISER, Cyril, P.A.S.I., Heworth Grange, York.
*1895. MONCREIFFE, Sir Robert D., Bart. of Moncreiffe, Perth.
1897. MOON, Frederick, Forester, Bowmont Forest, Roxburgh.
*1906. MOON, John Laurence, Forest Ranger, Forestry Department, Nairobi, British East Africa.
1907. MOORE, Frederick G., Assistant Forester, Estate Office, Colwyn Bay.
*1897. MORGAN, Alex., Timber Merchant, Crieff, Perthshire.
*1899. MORGAN, Andrew, Assistant Factor, Glamis.

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*1895. MORGAN, Malcolm, Timber Merchant, Crieff, Perthshire.
1907. MORRISON, Andrew, Estate Manager, Brodie Mains, Forres.
1895. MORRISON, Hew, LL.D., Librarian, Edinburgh Public Library.
1903. MORRISON, William, Manufacturer, 80 Park Road, Glasgow.
1905. MORTON, Andrew, Assistant Forester, Liverpool Corporation, Brinscall, Chorley, Lancashire.
1905. MOTHERWELL, A. B., Writer, Airdrie.
1907. MOULTRIE, James, Assistant Forester, Star, Balbirnie, Markinch.
1906. MOWAT, John, Overseer, Hazelhead Estate, Aberdeen.
1906. MUIR, William, Estate Clerk, Broomlands, Kelso.
1890. MUIRHEAD, George, F.R.S.E., Commissioner, Speybank, Fochabers.
1901. MULLIN, John, Forester, Eglinton Castle, Irvine.
1904. MUNRO, Alexander, Overseer, Invereshie, Kincraig.
1903. MUNRO, Alexander J., 48 Castle Street, Edinburgh.
1895. MUNRO, Donald, Assistant Forester, Holkham Hall, Norfolk.
1906. MUNRO, Donald, Wood Merchant, Ravenswood, Banchory.
1902. MUNRO, George A., S.S.C., 6 Rutland Square, Edinburgh.
1905. MUNRO, Sir Hector, Bart. of Foulis Castle, Evanton, Ross-shire.
*1902. MUNRO, Hugh Thomas, Lindertis, Kirriemuir.
1907. MUNRO, John, Assistant Forester, Craigo, by Montrose.
1907. MUNRO, John, Land Steward and Forester, The Lodge, Tarland, Aberdeenshire.
*1892. MURRAY, Alexander, Forester, Murthly, Perthshire.
1904. MURRAY, Charles A., of Taymount, Stanley.
1901. MURRAY, David, Gardener, Culzean Gardens, Maybole.
1906. MURRAY, David, Assistant Forester, Windsor Cottage, Fern, by Brechin.
1900. MURRAY, George J. B., Forester, Garthgwynion Hall, Machyneleth, North Wales.
1905. MURRAY, James, Farmer, Outerston, Gorebridge.
1902. MURRAY, Bailie John, J.P., 9 Strathearn Road, Edinburgh.
1900. MURRAY, John C., F.S.I., Factor and Commissioner, Haggs Castle, Glasgow.
1904. MURRAY, John M., Assistant Forester, Royal Botanic Garden, Edinburgh.
1900. MURRAY, William, of Murraythwaite, Ecclefechan, Dumfriesshire.
*1896. MURRAY, William Hugh, W.S., 48 Castle Street, Edinburgh.

*1899. NAIRN, Sir Michael B., Bart. of Rankeillour, Manufacturer, Kirkcaldy.
1904. NAIRN, Robert, Forester, Rowallan, Kilmarnock.
1907. NASH, William, Assistant Forester, Airdsmill, Muirkirk, Ayrshire.
*1905. NASMYTH, Norman, of Glenfarg, Glenfarg Lodge, Abernethy.
1894. NEIL, Archibald, Forester, Warkton, Kettering, Northamptonshire.
1893. NELSON, Robert, Assistant Forester, Hannahgate Cottage, Kinmount Estate, Cummertrees, Dumfriesshire.
*1908. NELSON, Thomas Arthur, of Achnacloich, Connel, Argyleshire.
1907. NICHOLSON, Daniel, Forester, Erskine, Bishopton.
1893. NICOL, James, Forester, Aird's Mill, Muirkirk, Ayrshire.

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1895. NICOL, James, Forester, Croxteth, Liverpool.
1906. NICOL, William, Forester, Cluny Castle, Ordhead, Aberdeenshire.
*1903. NICOL, William Edward, D.L., J.P., of Ballogie, Aboyne.
1901. NICOLL, William Peter, Assistant Forester, Kippo, Kingsbarns, Fife.
*1901. NICOLSON, Edward Badenach, Advocate, 12 Atholl Crescent, Edinburgh.
1893. NISBET, J., D.Œc., Royal Societies' Club, 63 St James Street, London, S.W.
*1902. *Nisbet, Robert C., Farmer, Kingsknowe, Slateford.*
*1899. NOBBS, Eric Arthur, B.Sc., Department of Agriculture, Cape Town.
1899. NOBLE, Charles, Forester, Donibristle, Aberdour.
1904. NOBLE, Hugh, Assistant Forester, Aldowrie Estate Office, Dores, Inverness.

1906. OGILVIE, Thomas, D.L., J.P., Kepplestone, Aberdeen.
1900. OLIPHANT, Joseph, Assistant Forester, Quarterbank, Abercairney, Crieff.
*1894. ORKNEY, William C., Surveyor's Office, Montrose Royal Asylum.
*1899. ORR-EWING, Sir Archibald Ernest, Bart., Ballikinrain Castle, Balfron.
*1906. ORR, George W., Cowdenhall, Neilston.
1906. ORR, Harry D., Timber Merchant, 73 Saltergate, Chesterfield.
1907. OSWALD, Major Julian, Kindar Lodge, New Abbey, Dumfries.
1902. OSWALD, Richard Alexander, of Auchincruive, Ayr.
1906. OWEN, Harry, Assistant Forester, Chatsworth, Pilsley, Bakewell.

1875. PAGE, Andrew Duncan, Land Steward, Culzean Home Farm, Ayr.
1908. PARK, Robert, Contractor, Hamilton Street, Motherwell.
1900. PATERSON, George, Timber Merchant, 64 Queen's Road, Aberdeen.
*1879. PATON, Hugh, Nurseryman, Kilmarnock, Ayrshire.
*1898. PATON, Robert Johnston, Nurseryman, Kilmarnock.
*1902. PATON, Tom W., Nurseryman, Kilmarnock.
1898. PATTERSON, Thomas L., Nisbet, Pentcaitland, East Lothian.
1897. PEARSON, James, Forester, Sessay, Thirsk, Yorks.
1899. PEARSON, James, Assistant Factor, The Cottage, Airdrie.
1869. PEEBLES, Andrew, Estate Office, Albury, Guildford, Surrey.
*1900. PERRINS, C. W. Dyson, of Ardross, Ardross Castle, Alness.
1904. PETERS, William, Assistant Forester, Gateside, Markinch, Fifeshire.
*1897. PHILIP, Alexander, Solicitor, Brechin, Forfarshire.
*1895. PHILIP, William Watt, Factor, Estate Office, Gigha, Argyleshire.
*1896. PHILP, Henry, jun., Timber Merchant, Campbell Street, Dunfermline.
*1896. PHILP, John, Timber Merchant, Campbell Street, Dunfermline.
1907. PILLAY, M. Nagalingom, Banker and Estate Agent, Meenakshipuram, Nagercoil, South India.
1903. PIRRIE, John, Sawmaker, Giles Street, Leith.
1896. PITMAN, Archibald Robert Craufurd, W.S., 48 Castle Street, Edinburgh.
1902. PLUMMER, C. H. Scott, of Sunderland Hall, Selkirk.
1901. POLLOCK, Alexander, Rustic Builder, Tarbolton, Ayrshire.
1897. POOLE, Wm., Corn Exchange Buildings, Edinburgh.
1902. POPERT, E. P., Assistant Surveyor, Forest of Dean, Coleford, Gloucestershire.

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Date of Election.

1899. PORTEOUS, George, Kenmore, Broomieknowe, Lasswade.
1899. PORTEOUS, Colonel James, of Turfhills, Kinross.
*1856. PORTSMOUTH, The Right Hon. the Earl of, Eggesford, North Devon.
1896. PRENTICE, George, Strathore, Kirkcaldy, Fife.
1899. PRICE, Aaron W., Forester, Bolstone, Ross-on-Wye.
*1898. PRICE, W. M., Factor, Minto, Hawick.
1908. PRITCHARD, Henry A., Professor of Estate Management and Forestry, Royal Agricultural College, Cirencester.
1908. PROCTOR, John, Assistant Forester, Bowmont Forest, Roxburgh.
*1878. PUNCHARD, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.
1907. PURVIS, George, Assistant Forester, Doune Lodge, Doune.

1907. RAE, Frederick S., Assistant Forester, Dalzell Farm, Motherwell.
1907. RAE, Louis, Assistant Forester, Dalzell Estate, Motherwell.
*1876. RAE, William A., Factor, Murthly Castle, Perthshire.
1901. RAFFAN, Alexander, Forester, Fairburn, Ross-shire.
1898. RAFFAN, James, Estate Steward, Fota Farm, Carrigtwohill, Co. Cork.
1899. RAFN, Johannes, Tree-Seed Merchant, Skovfrökontoret, Copenhagen, F.
1902. RALPH, William, I.S.O., Forrester Road, Corstorphine.
1897. RALSTON, A. Agnew, Factor, Philipstoun House, West Lothian.
1907. RALSTON, Charles W., Chamberlain on Dukedom of Queensberry, Dabton, Thornhill, Dumfriesshire.
*1908. RALSTON, Claude, Factor, Estates Office, Glamis.
1904. RALSTON, Gavin W., M.A., Advocate, 6 Abercromby Place, Edinburgh.
1907. RAMSAY, William, J.P., Longmorn House, Longmorn R.S.O.
*1855. RAMSDEN, Sir John, Bart., Byram Hall, Ferrybridge, Normanton.
1870. RATTRAY, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1908. REDPATH, James, Forester, Athelstaneford, Drem.
1908. REDPATH, John, Forester, Paxton, Berwick-on-Tweed.
1905. REID, Alexander T., Assistant Forester, Raith, Kirkcaldy.
1905. REID, Andrew, The Gardens, Durris, Drumoak, Aberdeenshire.
1901. REID, Hugh, Forester, Ashton Court, Long Ashton, near Bristol.
1894. REID, James S., Forester, Balbirnie, Markinch, Fife.
1900. REID, John, Estate Overseer, The Mains, Lochgelly.
1907. REID, John, Assistant Forester, Doune Lodge, Doune.
1906. REID, Richard, Assistant Forester, Sunlaws Hill, Roxburgh.
1905. REID, Robert, Overseer, Kincairney, Dunkeld.
1903. REID, Robert Matelé, Druimneil, Appin, Argyleshire.
1901. RENNIE, Joseph, Overseer, Hillend, Possil, Maryhill.
*1873. RICHARDSON, Adam D., 6 Dalkeith Street, Joppa.
1907. RILLIE, Joseph, Assistant Forester, Douglas, Lanarkshire.
1892. RITCHIE, Alexander, Overseer, Brucehill, Cardross Estate, Port of Menteith.
*1908. RITCHIE, Charles Ronald, Law Apprentice, 37 Royal Terrace, Edinburgh.
*1876. RITCHIE, William, Hope Lodge, Moffat.
1898. RITCHIE, Wm., Assistant Forester, Moss-side Cottage, Lynedoch, Perth.

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1906. RITCHIE, William Hamilton, of Dunnottar, Dunnottar House, Stonehaven.
1906. ROBB, Archibald, Riverslea, Rothes.
1900. ROBB, John, Road Surveyor, County Buildings, Edinburgh.
1907. ROBERTS, James, Assistant Forester, Goldsborough Mill, Knaresborough, Yorks.
1904. ROBERTSON, Alexander, Assistant Forester, Meikledams, Durris.
*1897. ROBERTSON, A. Barnett, Forester, The Dean, Kilmarnock, Ayrshire.
1897. ROBERTSON, Andrew N., Forester, Glenferness, Dunphail.
1899. ROBERTSON, Charles, Forester, Colstoun Old Mill, Gifford.
*1879. ROBERTSON, Donald, Forester, Dunrobin, Golspie.
*1907. ROBERTSON, Edward Hercules, B.A., Advocate, Burnside, Forfar.
1896. ROBERTSON, George, Forester, Ponsbourne Park Estate, near Hertford.
1900. ROBERTSON, James, Assistant Forester, Garth, Fortingall, Aberfeldy.
1904. ROBERTSON, James, Assistant Forester, Pollok Estate, Pollokshaws.
*1866. ROBERTSON, Jas., Wood Manager, Panmure, Carnoustie, Forfarshire.
*1905. ROBERTSON, James Morton, of Cowieslinn, Portmore House, Eddleston.
1905. ROBERTSON, James W., Head Gardener, Letham Grange and Fern, Arbroath.
1907. ROBERTSON, J. P., Forester, Edensor, Bakewell.
*1905. ROBERTSON, John, Factor, Panmure Estates Office, Carnoustie.
1896. ROBERTSON, John, Forester, Altyre, Forres.
1902. ROBERTSON, R. A., M.A., B.Sc., Lecturer on Botany, University, 119 South Street, St Andrews.
1906. *Robertson, Robert Mackenzie, Assistant Forester, Chatsworth, Pilsley, Bakewell.*
1895. ROBERTSON, Thomas, Forester and Bailiff, Woodlawn, Co. Galway.
1907. ROBERTSON, Thomas, Forester, Vogrie, Gorebridge.
1883. ROBERTSON, William, Assistant Forester, Ringwood, Birnam, Perth.
1902. ROBINSON, Stewart, Lynbales, Kington, Herefordshire.
*1890. ROBINSON, William, Gravetye Manor, East Grinstead, Sussex.
1899. ROBSON, Alex., of Smith & Son, 18 Market Street, Aberdeen.
1901. ROBSON, Alexander, Head Gamekeeper, The Kennels, Culzean, Maybole.
*1897. ROBSON, Charles Durie, 66 Queen Street, Edinburgh.
1900. ROBSON, John, Assistant Forester, Baronscourt, Co. Tyrone.
1893. RODGER, James, Forester, Leinster Street, Athy, Co. Kildare.
*1883. ROLLO, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.
1893. ROMANES, James, C.A., Fordel, Melrose.
*1872. ROSEBERY, The Right Hon. the Earl of, K.G., K.T., Dalmeny Park, Edinburgh.
1898. ROSS, Charles D. M., Factor, Abercairney, Crieff.
1887. ROSS, John, Forester, Hopetoun, South Queensferry, Linlithgowshire.
1905. ROSS, John S., Factor's Clerk, Monreith Estate Office, Wigtownshire.
1907. ROSS, Colonel Walter C., Cromarty.
*1906. ROXBURGHE, His Grace the Duke of, K.T., Floors Castle, Kelso.
1903. RULE, John, Forester, Huntly.

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1893. RUTHERFORD, James A., Land Agent, Highclere Park, Newbury, Berks.
1870. RUTHERFORD, John, Forester, Linthaugh, Jedburgh, Roxburghshire.
1904. RUTHERFURD, Henry, Barrister-at-Law, Fairnington, Roxburgh.
1901. RYAN, Thomas, The Gardens, Castlewellan, Co. Down.

1894. SAMSON, David T., Seafield Estates Office, Grantown, Strathspey.
1875. SANG, Edmund, of E. Sang & Sons, Nurserymen, Kirkcaldy.
*1906. SANG, J. H., LL.B., W.S., Westbrook, Balerno.
1904. SANGSTER, Alexander, The Mall, Montrose, c/o Bourlos Land Co., Belcas, Egypt.
1903. SCHOTT, Dr Peter Carl, Nursery and Seed Establishments, Knittelsheim, Palatinate, Germany.
*1867. SCOTT, Daniel, Wood Manager, Darnaway, Forres.
1892. SCOTT, David, Overseer, Dumfries House, Cumnock, Ayrshire.
1901. SCOTT, Frank, Forester, Comlongon Castle, Ruthwell.
1881. SCOTT, James, Forester, Wollaton Hall, Nottingham.
*1907. SCOTT, James Cospatrick, P.A.S.I., Yarrow Cottage, Poynder Place, Kelso.
1903. SCOTT, John, Forester, Annfield, Hartrigge, Jedburgh.
1908. SCOTT, John A., Assistant Forester, Bowmont Forest, Roxburgh.
1890. SCOTT, John D., Land Steward, Estate Office, Brushford, Dulverton, Somerset.
*1906. SCOTT, John Henry Francis Kinnaird, of Gala, Gala House, Galashiels.
1906. SCOTT, Robert, Solicitor, *Hon. Secretary and Treasurer, Aberdeen Branch*, 230 Union Street, Aberdeen.
*1902. SCRIMGEOUR, James, Gardener, Manor House, Donaghadee.
*1890. SCRIMGEOUR, John, Overseer, Doune Lodge, Doune.
1897. SHARPE, Thomas, Forester, Monreith, Port William, Wigtownshire.
1893. SHAW, Andrew, Victoria Saw-mills, Perth.
1904. SHAW, John, Overseer, The Glen Cottage, Cardross.
*1896. SHAW-STEWART, Sir Hugh, Bart., M.P., of Ardgowan, Greenock.
*1904. SHELLEY, Sir John Courtown Edward, Bart., Avington, Alresford, Hants.
*1898. SHEPPARD, Rev. H. A. Graham-, of Rednock, Port of Menteith, Stirling.
*1907. SHIACH, Gordon Reid, L.D.S., etc., Ardgilzean, Elgin.
*1903. SHIEL, James, Overseer, Abbey St Bathans, Grant's House.
1905. SHIELDS, James, Farmer, Longniddry.
1907. SHIELS, George Henry, Forester, Lethen, Nairn.
1905. SIM, John, Forester, Fernybrae, Cornhill, Banffshire.
1903. *Simon, Thomas, jun., Assistant Forester, Montrave, Leven.*
1906. SINCLAIR, Robert, Factor for North Harris, Harris, by Portree.
1900. SINGER, John G., Forester, Culzean, Ayr.
1907. SKIRVING, Robert, D.L., J.P., of Cobairdy, Huntly, Aberdeenshire.
1868. SLATER, Andrew, Estate Office, Durrington, Salisbury, Wilts.
1899. SLEIGH, Charles W., M.A., Factor, Blackwood Estate Office, Lesmahagow.

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Date of Election.

1902. SMART, John, Merchant, 18 Leith Street, Edinburgh.
1901. SMITH, Allan, Land Steward, Dunira, Comrie.
*1893. SMITH, Charles G., Factor, Haddo House, Aberdeen.
1906. SMITH, Douglas, P.A.S.I., Land Agent, Estate Office, Stanage Park, Brampton Bryan, Herefordshire.
1904. SMITH, D. D., Nurseryman and Seed Merchant, St Catherine's Street, Cupar, Fife.
1908. SMITH, Edwin Hedley, B.L., Factor, Whittinghame, Prestonkirk.
1873. SMITH, G. B., Wire Fence Manufacturer, Phœnix Ironworks, Govan.
1901. SMITH, James, Forester, 1 Oxmantown Mall, Birr, King's County.
1908. SMITH, James, Nurseryman, Darley Dale Nurseries, near Matlock.
1908. SMITH, James, Assistant, Jeaniebank, Old Scone, Perth.
1906. SMITH, James Fraser, F.R.H.S., late Gardener, Barons Hotel, Auchnagatt.
1907. SMITH, Right Hon. James Parker, P.C., Jordanhill, Glasgow.
1895. SMITH, John, Cabinetmaker, 1 Eastgate, Peebles.
1907. SMITH, John, Factor, Inverallan, Grantown-on-Spey.
*1907. SMITH, J. Grant, Factor for Glenurquhart, Seafield Estates Office, Elgin.
1901. SMITH, Matthew, Manager for Dyer & Co., Peebles.
1901. SMITH, Sydney, Factor, Drummuir Estates Office, Keith.
1901. SMITH, Thomas, Factor, The Castle, Maybole.
*1895. SMITH, Thomas, Overseer, The Nursery, Tring Park, Wiggington, Tring, Herts.
1896. SMITH, William, Forester, Camperdown, Dundee.
1899. SMITH, William, Overseer, Fairnalee, Clovenfords, Galashiels.
*1896. SMITH, William G., B.Sc., Ph.D., Lecturer on Botany, University of Leeds.
*1907. SMITHSON, Harry S. C., of Inverernie, Daviot, Highland R.S.O.
*1882. SMYTHE, David M., of Methven Castle, Perth.
1906. SMYTHE, George Henderson, late Gardener, Balcarres Hotel, Echt, Aberdeenshire.
1907. SOMERSET, His Grace the Duke of, Maiden Bradley, Bath; 35 Grosvenor Square, W.
1906. SOMERVILLE, Hugh Christopher, 2 Fairhaven, Dalkeith.
1906. SOMERVILLE, Robert Anderson, Eastwoodbrae, Dalkeith.
*1889. SOMERVILLE, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Professor of Rural Economy, Oxford.
1904. SOUTAR, William, Forester, The Farm, Titsey Place, Limpsfield, Surrey.
1898. SPENCE, William, Forester, Strathenery, Leslie.
*1899. SPIERS, Adam, Timber Merchant, Warriston Saw-mills, Edinburgh.
*1883. SPROT, Major Alexander, of Garnkirk, Chryston, Glasgow.
1899. STALKER, Wm. J., Nurseryman, Nairn.
1903. STEPHEN, Alfred, Assistant Forester, Drumtochty, Fordoun.
1907. STEPHEN, John, Forester, Dell Nursery, Nethy Bridge.
1904. STEVEN, William, Builder, Muirpark, Dalkeith.
1902. STEVENSON, Allan, Architect, 14 Cathcart Street, Ayr.
1899. STEWART, Alex., Forester, Shadwell Court, Thetford.

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1905. STEWART, Alexander, Box 72, Holland, Manitoba, Canada.
1901. STEWART, Alistair D., Camperdown Estates Office, Dryburgh, Lochee.
1897. STEWART, Charles, Forester, Castle Menzies, Aberfeldy.
1907. STEWART, David, Assistant Forester, Royal Botanic Garden.
*1899. STEWART, Duncan D., Factor, Rossie Estate, Inchture.
1901. STEWART, James, Forester, Letham and Fern Estates, Fern, near Brechin.
1903. STEWART, John, Forester, Cavens, Kirkbean, Dumfries.
1901. *Stewart, John M., Forester, Grigorhill, Kinsteary, Nairn.*
*1892. STEWART, Sir Mark J. M'Taggart, Bart. of Southwick, Kirkcudbrightshire.
1908. STEWART, Colonel R. K., of Murdostoun, Murdostoun Castle, Lanarkshire.
1876. STEWART, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
1899. STEWART, William, Land Steward, Dalhousie Castle, Lasswade.
1906. STEWART, William Maitland, Factor, 5 Inverleith Terrace, Edinburgh.
*1904. STIRLING, Archibald, of Keir, Dunblane.
1907. STIRLING, John Alexander, of Kippendavie, Dunblane.
1904. STOBO, Robert W., Assistant Forester, c/o Mrs Luckins, Wardley Marsh, Liphook, Hants.
1897. STODDART, James, Builder, Bonnyrigg, Midlothian.
1906. STODDART, James, jun., Joiner, Norwood, Bonnyrigg.
1902. STONE, Alfred William, Clerk of Works, Ashton Court Estate, Bower, Ashton, Bristol.
1893. STORIE, W., Whitway House, Newbury, Berks.
1906. STRACHAN, James, Gardener, Cruickshank Botanic Garden, Old Aberdeen.
*1908. STRATHMORE AND KINGHORNE, The Earl of, Glamis Castle, Glamis.
1906. STUART, Peter, Brewer, Glen Grant, Rothes.
1902. STUNT, Walter Charles, Lorenden, Ospringe, Kent.
*1880. SUTHERLAND, Evan C., Highland Club, Inverness.
1907. SUTHERLAND, George, Assistant Forester and Saw-miller, Doune Lodge, Doune.
*1883. SUTHERLAND, His Grace the Duke of, K.G., Dunrobin Castle, Golspie.
1892. SUTHERLAND, John D., Solicitor and Estate Agent, Oban, Argyle.
1906. *Swankie, Frank Murray, Assistant Forester, Vayne, Fern, Brechin.*

1869. TAIT, David, Overseer, Owston Park, Doncaster, Yorkshire.
*1892. TAIT, James, Builder, Penicuik, Midlothian.
*1900. TAIT, James, jun., Woodsbank, Penicuik.
1898. TAIT, William, Seedsman, 75 Shandwick Place, Edinburgh.
1895. TAIT, Wm. A., 13 Brandon Terrace, Edinburgh.
1902. TAYLOR, John, Forester, Glentulchan, Glenalmond, Perthshire.
1904. TAYLOR, Robert, Assistant Forester, Chapelhill, Logiealmond, Methven.

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1905. TAYLOR, Robert, Forester, Broomhall Estate, Charlestown, Fife.
1897. TAYLOR, William, Forester, Sandside, Kirkcudbright.
1905. TELFER, John, Assistant Forester, Heckfield, Winchfield, Hants.
*1891. TENNANT, Sir Edward P., Bart. of The Glen; 31 Lennox Gardens, London, S.W.
*1877. TERRIS, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1904. THOMPSON, Dugald, Forester, Drimsynie, Lochgoilhead.
1893. THOMSON, David W., Nurseryman, 113 George Street, Edinburgh.
1903. THOMSON, John Burnside, Estate Manager, Calderwood Castle, High Blantyre.
*1855. THOMSON, John Grant, Wood Manager, Grantown, Strathspey.
*1902. THOMSON, Peter Murray, S.S.C., Cockbridge, Mealsgate, Cumberland.
1903. THOMSON, Robert, Foreman Forester, Park Hill, Ampthill, Bedfordshire.
*1901. THOMSON, Spencer Campbell, of Eilean Shona, 10 Eglinton Crescent, Edinburgh.
1904. THREIPLAND, Captain W. Murray, Dryburgh Abbey, St Boswells.
1906. TINDAL, Robert, Forester, Bellspool Cottages, Stobo.
1901. TIVENDALE, William D., Head Forester to Duke of Portland, Burnhouse, Galston.
*1871. TOMLINSON, Wilson, Forester, Clumber Park, Worksop, Notts.
1906. TOSH, Hendry, Assistant Forester, Bridgend, Inverkip, Greenock.
*1906. TRAIL, James William Helenus, A.M., M.D., F.R.S., Professor of Botany in University of Aberdeen, 71 High Street, Old Aberdeen.
*1902. TROTTER, A. E. C., of Bush, Milton Bridge, Midlothian.
*1903. TULLIBARDINE, The Most Hon. the Marquis of, D.S.O., Blair Castle, Blair Atholl.
1900. TURNBULL, Andrew, Assistant Forester, Picktree, Chester-le-Street, Co. Durham.
1903. TURNBULL, John, Forester, Arbigland, Dumfries House Station, Cumnock.
1898. TWEEDIE, Alexander, Forester, Faskally, Pitlochry.

1883. UNDERWOOD, Henry E., Fornham, St Martin, Bury St Edmunds, Suffolk.
*1903. UNWIN, Arthur Harold, D.Œc., Town House, Haslemere, Surrey.
*1908. URQUHART, Angus, Assistant Nursery and Seedsman, Inverness.
*1872. URQUHART, B. C., of Meldrum, Aberdeenshire.
*1902. URQUHART, Farquhar, Nurseryman, Inverness.
1907. URQUHART, Colonel Robert, Town Clerk, Forres.
*1908. USHER, Sir Robert, Bart. of Norton and Wells, Norton, Ratho Station, Midlothian.
1903. USHER, Thomas, Factor, Courthill, Hawick.

1903. VEITCH, John, Factor, Fasnacloich.

1903. WALKER, Captain George Lawrie, of Crawfordton, Thornhill.
1894. WALKER, Henry H., Factor, Monreith, Port William, Wigtownshire.
*1878. WALKER, Colonel I. Campbell, Newlands, Camberley, Surrey.

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*1907. WALKER, James, Wood Merchant, Inverness.
*1906. WALKER, John Steven, Yard Foreman, Saw-mills, Hurlford, Ayrshire.
*1906. WALKER, Robert Williamson, C.E., Factor and Land Surveyor, 3 Golden Square, Aberdeen.
1870. WALL, G. Y., Land Agent, Grange House, Darlington, Durham.
1903. WALLACE, Andrew, Saw-miller, Gateside, Balbirnie, Markinch.
1893. WALLACE, David P., Forester, The Saw-mills, Filleigh, Molton, S. Devon.
*1897. WALLACE, John A. A., of Lochryan, Cairnryan, Stranraer.
1893. WALLACE, Robert B. P., Timber Merchant, 12 Danube Street, Edinburgh.
*1905. WALLACE, Thomas Douglas, F.S.I., Callendar Estate Office, Callendar Park, Falkirk.
1899. WANDESFORDE, R. H. Prior, of Castlecomer, Co. Kilkenny.
*1900. WARWICK, Charles, 19 Woodfield Road, Tonbridge, Kent.
1901. WASON, Right Hon. Eugene, M.P., of Blair, Dailly, Ayrshire; 8 Sussex Gardens, Hyde Park, London.
1903. WATSON, Hugh, Forester, Sunnyside Cottages, Maybole.
1901. WATSON, James, Manager, Moy Hall, Inverness-shire.
1893. WATSON, John, Timber Merchant, Annandale Street, Edinburgh.
*1893. WATSON, John T., 6 Bruntsfield Gardens, Edinburgh.
1872. WATT, James, J.P., of Little & Ballantyne, Nurserymen, Carlisle.
1893. WATT, James W., Knowefield Nurseries, Carlisle.
1889. *Watters, Dennis, Forester, Wester Elchies, Carron, Strathspey.*
1904. WEALE, James A., Timber Merchant, Boundary Place, Liverpool.
1906. WEBSTER, Charles, Gardener and Forester, The Gardens, Gordon Castle, Fochabers.
*1891. WELSH, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
*1871. WEMYSS, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.
1904. WENTWORTH-FITZWILLIAM, George Charles, of Milton, Peterborough.
1902. WHELLENS, Henry, Forester, Gregynog, near Newtown, Montgomeryshire.
1905. WHITE, Andrew, Forester, Portmore, Eddleston.
*1898. WHITE, J. Martin, Balruddery, near Dundee.
1895. WHITE, William, Farmer, Gortonlee, Lasswade.
1905. WHITTINGHAM, Edwin, Contractor, St Mary's, Newport, Salop.
*1884. WHITTON, James, Superintendent of Parks, 249 George Street, Glasgow.
*1899. WHYTE, John D. B., Factor, Estate Office, Elveden, Suffolk.
1901. WHYTOCK, James, The Palace Gardens, Dalkeith.
1895. WIGHT, Alexander, Overseer, Thurston, Innerwick.
*1869. WILD, Albert Edward (Conservator of Forests, Darjeeling, India), c/o Henry S. King & Co., 65 Cornhill, London, E.C.
1883. WILKIE, Charles, Forester, Lennoxlove, Haddington.
1891. WILKIE, G., Architect, Hayfield, Peebles.
1904. WILKINSON, Henry Bevis, Factor, Holmhead, Corsock, Dalbeattie.
1902. WILKINSON, John, Factor, The Grange, Kirkcudbright.
1903. WILL, George, Manager, Crichton Royal Institution Farm, Dumfries.

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1895. WILLIAMSON, John, Bank Agent, Loanhead, Midlothian.
*1907. WILLIAMSON, John, Joiner and Builder, Grangemouth.
1907. WILSON, Adam Frank, C.D.A.(Edin.), Reedieleys, Auchtermuchty.
1907. WILSON, Andrew Robertson, M.A., M.D., Hopewell, Tarland, Aboyne, Aberdeenshire.
*1898. WILSON, David, Timber Merchant, Troon, Ayrshire.
*1889. WILSON, David, jun., of Carbeth, Killearn, Glasgow.
1908. WILSON, Edward Arthur, Rockingham, Edgbaston Park Road, Birmingham.
1907. WILSON, Ian Hall, Saw-mill Manager, Brodie Cottage, Brodie.
1896. WILSON, James, M.A., B.Sc., Royal College of Science, Stephens Green East, Dublin.
1900. WILSON, James, jun., Nurseryman, St Andrews.
1907. WILSON, James G., Assistant, Dalzell Estates Office, Motherwell.
1904. WILSON, James Watt, Seedsman and Nurseryman, Perth.
1902. WILSON, Sir John, Bart. of Airdrie.
1901. WILSON, John Currie, Factor, Tulliallan Estate Office, Kincardine-on-Forth.
1897. WILSON, John H., D.Sc., F.R.S.E., Lecturer on Agriculture and Rural Economy, The University, St Andrews.
1903. WILSON, Thomas, Head Gardener, Glamis Castle, Glamis.
1899. WILSON, William, Timber Merchant, Auchenleck, Ayrshire.
*1904. WINK, John, Solicitor, High Street, Elgin.
1893. WISEMAN, Edward, Nurseryman, Elgin.
1895. WISEMAN, William, Nurseryman, Forres.
1906. WOLFE, George, sen., J.P., Shovel Manufacturer, Millburn, Bathgate.
1904. WOOD, James, Forester, Marr Doncaster, Yorkshire.
1907. WOOD, Thomas, Forester, Pitfour, Aberdeenshire.
1907. WOOLFORD, Albert, Assistant Forester, Ragmore, Heckfield, Winchfield.
1904. WORSFOLD, Edward Mowll, Land Agent, Christ Church Villas, Priory Road, Dover.
1904. WOTHERSPOON, George, Factor, Cromartie Estate Office, Kildary, Ross-shire.
1904. WRIGHT, Robert Patrick, F.H.A.S., F.R.S.E., Principal of West of Scotland Agricultural College, Blythswood Square, Glasgow.
1906. WYLAM, Ralph J., Assistant Forester, Chester Lodge, Lambton Park, *via* Chester-le-Street.
1868. WYLLIE, George, Ballogie, Aboyne, Aberdeenshire.
1906. WYLLIE, William, Seedsman, 18 Market Street, Aberdeen.

1897. YEATS, Alexander, Talbot Stettler, Alberta, Canada.
1904. YOOL, Thomas, Factor, Menzies Estates Office, Aberfeldy.
1905. YOUNG, John, Hedger, West Lodge, Corehouse, Lanark.
1908. YOUNG, John, Hedger and Assistant Forester, Muirhouse, Falkirk.
1907. YOUNG, John U., Cart Craigs, Pollokshaws.
1875. YOUNG, William, Forester, Morriston Cottage, Earlston, Berwickshire.
*1898. YOUNGER, Henry J., of Benmore and Kilmun, Greenock.
*1899. YULE, Miss Amy Frances, L.A., Tarradale House, Muir of Ord.

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